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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[NOTICE.]

Wrinkle Department, the American Gas Institute.

To the Membership, American Gas Institute: All members of the American Gas Institute, and others interested, are requested to contribute a description of any novel device or scheme covering any feature of the gas business. Every department of every company uses some novel stunt which would be of value to others. The object of this department is to compile such information. The value of the report depends entirely on the co-operation received. Send in your contribution at once to

MILAN R. BUMP, Editor,
60 Wall street, New York.

[OFFICIAL NOTICE.]

Change of Meeting Place, Michigan Gas Association.

MICHIGAN GAS ASSOCIATION,
OFFICE OF SECRETARY,
DETROIT, MICH., July 1, 1907.

To the Members, Michigan Gas Association: Owing to unavoidable delays in the completion of the new hotel at Kalamazoo, Mich., the Executive Committee has changed the place of meeting from Kalamazoo to Battle Creek, the meeting to be held September 18, 19 and 20, 1907. A notice will be sent in the near future giving full information in regard to hotels and programme, for papers as well as entertainment.

Respectfully,
ALONZO P. EWING, Secretary.

BRIEFLY TOLD.

THE DUBLIN MEETING OF THE BRITISH INSTITUTION OF GAS ENGINEERS.—That there's small odds between the gas managers of England and Ireland was pronouncedly shown on the occasion of the annual meeting of the British Institution of Gas Engineers, which was held in Dublin the third week of last month. The meeting room was the well-equipped hall of the Royal Dublin Society's Lecture Theater, which was well tested as to capacity when the Lord Mayor of Dublin (who bears the decidedly non-Celtic name of Nannetti), just prior to the fall of the gavel, assumed his position on the platform to the right of the chair of the Institute's respected, honored and admired President, Mr. Charles Hunt. Among the many remarkable things for which the session was noted perhaps certainly not the least striking was the attendance thereon of so many from abroad, prominent amongst whom were our own Mr. Robert M. Searle, of Rochester, N. Y., M. Marquisan, of the French Association of Gas Engineers, Mr. Paul Schlicht, of New York, Mr. M. Mizuta, from Tokio, Mr. Arthur F. P. Hayman, from Berlin, and Mr. J. Irminger, from Copenhagen—men all prominent in the gas business of their respective countries. Of those named Mr. Searle contributed a paper to the meeting on the subject of "High Pressure Distribution Development in the United States," but as the paper itself appears elsewhere in our current issue we will pass it up in the remark that it reads good to us. Mr. Schlicht's contribution had to do with the working of retorts for the production af gas as the main thing, and with the operating of closed vessels primarily for the production of coke. This paper will also go in the JOURNAL later on. The list contained many other papers of excellence which we also hope to reproduce. To our mind, however, the literary and interesting number on the programme was the address by President Hunt, which was in that master's best vein. While relating of necessity to detail that prevails rather in foreign lands than to that of ours, nevertheless it has very much which will appeal to a gas worker in the States. It is, as a whole, a timely contribution to gas literature that will stand for many a day. Another paper which would be undoubtedly of great interest to our "Commercial Engineers" is that on "The Sale of Gas," by Mr. F. W. Goodenough, Chief Inspector to the great Gas Light and Coke Company.

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of London. It is a very thorough and complete exposition of the current methods of obtaining new trading and retaining present business as carried on by the management of the largest gas company in the world. Take it all in all, the meeting was an excellent one in every respect, and although the weather was of the order that even in penance plans sprinkles anew, the heartiness of the hosts was of the order that causes real Irishmen to be regarded as kings.

THE MEMBERS OF THE PUBLIC SERVICE COMMISSIONS OF NEW YORK.—The members of the Public Service Commissions of New York, as originally appointed to office, and as now serving, are: First District, comprising all of Greater New York: William R. Willcox, Chairman, and William McCarroll, Edward M. Bassett, Milo Roy Maltbie and John E. Hustes - all of New York city, with headquarters in the city.

Second District, with headquarters in Albany, N. Y.: Frank M. Stevens, of Jamestown, Chairman; Thomas Mott Osborne, of Auburn; Charles Hallam Keep, of Buffalo; James E. Sague, of New Hamburg, and Martin S. Decker, of New Paltz. The first move affecting the gas industry in the first division is the arranging of a uniform plan for the testing and inspection of gas meters, which matter will be considered at length. Mr. A. E. Forstall has been retained by the Commission to act with it in an advisory capacity.

DEATH OF MR. RANDALL MORGAN, JR.—The fraternity will sorrow with Mr. Randall Morgan, Second Vice-President of the United Gas Improvement Company, of Philadelphia, over the untimely death of his son, Randall Morgan, Jr., who failed to rally from exhaustion superinduced by an operation for the removal of the vermiform appendix. He was operated on the afternoon of June 30th, at Dr. Ball's private hospital in this city, and died the following afternoon. Deceased was in his 21st year, and was in his junior year in the University of Pennsylvania. He was a bright, energetic, lovable fellow, and the suddenness of the termination of his career adds to the great shock that has caused his immediate relatives exceeding sorrow.

CURRENT COMMENT.—

WE are indebted to Mr. R. A. Field, Superintendent of the Rome (N. Y.) Gas, Electric Light and Power Company, for a copy of "Mrs. Fitzroy's Victory," which is the detailing of a gas range romance in six chapters. It is told in a style that is charming, and whoever is really responsible for the tale is to be complimented on having gotten up a narrative that will hold the attention of the house woman to a point where she will of necessity be impelled to try a gas range—it would make excellent reading, too, for the housewoman who knows all about gas as her tried and true ally. From the printer's standpoint the get up of the chapters is all to the good.

THE Kerr Murray Manufacturing Company is under contract to the Williamsport (Pa.) Gas Company to double the capacity of the existing purifying plant. In fact, the contract further means that the plant in this respect will be brought to date with the balance of the apparatus in the works.

MR. WILLIAM DARBEE has been appointed Assistant General Manager of the Consolidated Gas, Electric Light and Power Company, of Baltimore, Md. He was with the Albany and Hudson Railroad.

WHAT may be termed a case in point regarding California practice respecting forfeiture of franchise through delay in laying gas mains is shown in the following: "The Los Angeles Independent Gas Company laid its pipes through a number of the streets of Los Angeles, Cal., under Section 19, Article 11 of the State Constitution, which provides, in substance, that in any city where there are no public works for supplying artificial light, any individual or corporation may, under such regulations as the municipality shall prescribe, 'have the privilege of using the public streets and thoroughfares thereof, and of laying down pipes and conduits' to supply the city and its inhabitants with gas or other illuminating light. About 2 years after the pipes were placed in position the city brought an action to restrain the Company from exercising any rights under the franchise, claiming that certain patrons of the Company were using the gas for heating purposes, and that the Constitution only authorized the distribution of illuminating gas. It was held that this could not be made a ground upon which to base a forfeiture of the franchise. The same gas which furnished light also served for heating purposes, and the pipes and connections necessary for the one purpose made the gas available for the other purpose without subjecting the streets to any additional burden. [People *vs.* Los Angeles Independent Gas Co., Supreme Court of California, 89 Pac. Rep., 108.]"

MR. JAMES E. THEIM, since 1904 Supt. of the Standard Gas and Electric Company, of Raleigh, N. C., has resigned from its service in order to engage in business on his own account. His successor is Mr. Dwight F. Betts.

THE Poughkeepsie (N. Y.) Light, Heat and Power Company will extend its gas mains to the outlying suburb of Arlington,

High Pressure Distribution Development in the United States.

[A paper read by MR. R. M. SEARLE, Rochester, N. Y., at the Dublin meeting of the English Institution of Gas Engineers.]

Since Mr. F. H. Shelton, of Philadelphia, read his paper on "High Pressure Distribution" before the Western Gas Association, on 15th June, 1899, the development of high pressure distribution in the United States has been steady, sane and satisfactory. The proper policy has become so familiar to those in touch with it that the growth goes along now with as little comment as one would give low pressure distribution. The author must confess ignorance of just what is being done in England, and for this reason may speak of certain things which are already familiar. Yet he hopes he may give encouragement to others who may be in doubt, and help guide them to economies and profit that now seem impossible. His idea in writing this paper was to direct attention to those developments which have taken place in high pressure distribution work in the United States to bring it to the stage of perfection that now obtains, and he proposes to dwell more particularly on the appliances in use and the manner of using them, and, at the same time, if any members are sufficiently interested, he wishes to say that he has brought with him for the archives of the Institution copies of various papers read before the different societies in the United States, which contain accounts of all the interesting things said and done in high pressure distribution. They contain such a clear digest of the number of high pressure installations in action, the number of consumers satisfactorily supplied, miles of main in use, etc., that he feels compelled to bring them to attention, although it would be unfair to take time to speak of them in detail. They are as follows:

"Distributing Gas Under High Pressure," by F. H. Shelton. Read before Western Gas Association, June 15, 1899.

"Pumping Gas 5 Miles at 20 Pounds Pressure," by F. H. Shelton. Read before New England Association of Gas Engineers, Feb., 1900.

"Distributing Gas under High Pressure," by F. H. Shelton, *et al.* Read before Western Gas Association, May 16, 1900.

"Distributing Gas at High Pressure," by G. F. Goodnow. Read before Western Gas Association, May 22, 1902.

"Distribution of Gas at High Pressure," by F. H. Shelton. Read before Ohio Gas Light Association, 1902.

"High Pressure Gas Distribution," by John A. Britton. Read before Pacific Coast Gas Association, 1903.

"High Pressure Gas in Street Lighting," by J. J. Knight. Read before Ohio Gas Light Association, 1904.

"High Pressure Gas Distribution of To-Day," by H. L. Rice. Read before American Gas Light Association, Oct. 19, 1905.

He has also brought a printed volume of the "Proceedings" of the New England Association of Gas Engineers, 1902-3, containing the following articles on this subject:

"Distributing Artificial Gas at High Pressure in a Suburban Locality," by G. F. Goodnow and F. H. Shelton.

"Development of the Gas Distributing System of the Suburban Gas and Electric Company in Revere and Winthrop, Mass."

"Notes on High Pressure Distribution."

And a printed volume of the "Proceedings" of the Pacific Coast Gas Association, 1905-6, containing the following:

"The Compression and Transmission of Illuminating Gas," by E. H. Rix.

"Some Economies in High Pressure Gas Tranmission," by E. H. Rix.

"Experience with High Pressure Gas Mains," by Sherwood Grover.

"Some Economies in High Pressure Gas Transmission," hy E. H. Rix *et al.*

High pressure distribution in the United States is generally understood to be 5 pounds per square inch or over; and 50 pounds per square inch in mains just before peak load comes on is not uncommon.

Pipe Used.—In some of the earlier installations of high pressure systems, before just what could be delivered by high pressure was understood, much 8-inch, 6-inch and 4-inch pipe was laid, which, if the work were done over again, would be laid with 6-inch, 4-inch, 3-inch, 2-inch and 1-inch. With but one exception, all those with whom the author has spoken agree that the best pipe to use under all circumstances is full weight merchant's wrought iron pipe, although Mr. E. H. Witherby, the General Manager of the United Gas and Electric Company, of New York, has in use about 50 miles of universal joint cast iron pipe which has given such satisfaction that it is entitled to entrance into the high pressure distribution fold. For the

information of those not familiar with this meritorious article, the writer has brought with him a sample of the pipe showing its chief characteristics (Fig. 1). When laying wrought iron pipe, heavy

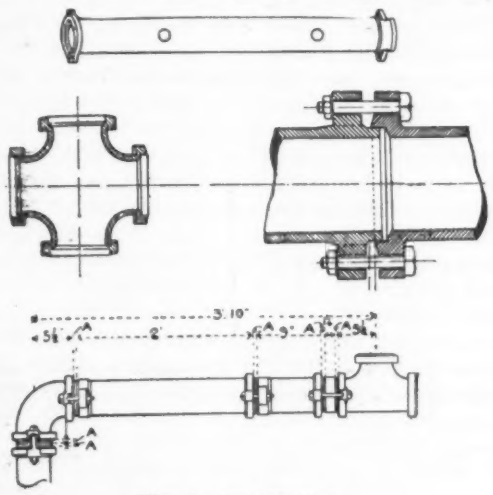


Fig. 1.—Cast Iron Pipe.

malleable, recessed, screwed couplings should be used; and it is important to have the joints well screwed home, also all threads thoroughly coated with red lead.

Developments have shown that gate valves should be put in mains every half mile, and that expansion joints - preferably of the "Dresser" type – be put in every 1,000 feet. In some of the original installations this contraction and expansion were not provided for, and cast iron valves and specials were pulled apart, which resulted in much serious loss, damage and inconvenience. A sample of a "Dresser" sleeve, as used in the States, also is exhibited (Fig. 2).

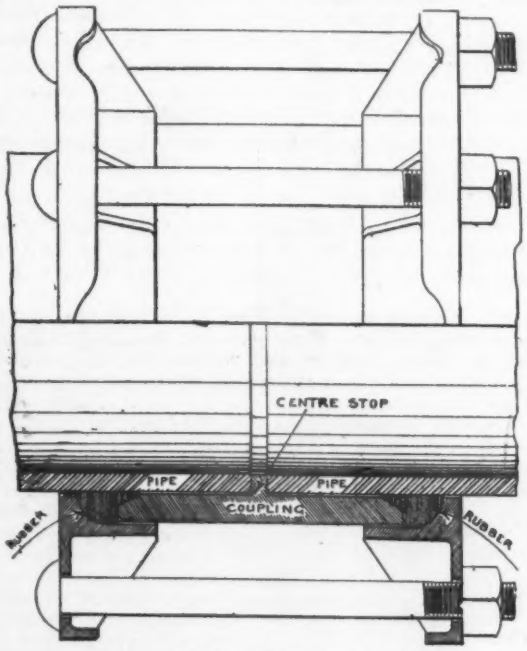


Fig. 2.—Dresser Sleeve.

Where lateral mains are taken off of the 4-inch or 3-inch direct trunk lines of 2-inch or 1-inch, they are connected as follows: A high pressure service saddle (Fig. 3) is bolted on to the larger main,

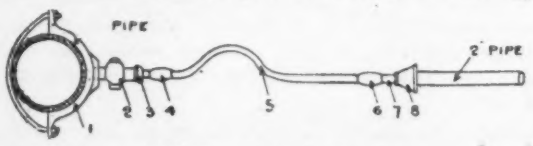


Fig. 3.—Service Saddle.

and a 1-inch extra heavy brass corporation cock is screwed into it. The main is then tapped through the cock, and the cock shut off, when an expansion loop of 1-inch extra heavy lead pipe is connected up between the trunk and lateral. To quote Mr. J. D. Shattuck, General Manager of the Suburban Gas Company, of Philadelphia, who has charge of one of the very large high pressure distribution systems, and a pioneer in the United States: "The size of the hole tapped in the main should always be determined by the amount of gas probably required on such side lines or laterals. If any accident happens to the side line, it does not immediately draw out all the gas from the main trunk lines. When you consider that a ¼-inch hole at 30 pounds pressure will pass 500,000 cubic feet in 24 hours, you can readily see that you do not need a full size opening into all side lines." All agree that the pipe should have at least 3 feet of cover; while many do not think it necessary to lay the pipe to grade.

For large capacities the main is tapped at the bottom and a service saddle is put on. A pipe is then run to a suitable wrought iron tank; a small pipe being brought to the level of the curb, where attachment is made to a suitable drip wagon – the pressure of gas, of course, displacing any deposit that may be in the tank. For small capacity drips wrought iron pipe is substituted for tank.

In the majority of cases wrought iron pipe is coated with Hickenlooper formula pipe coating before and after installing, which, for the sake of completing the record, is given below:

The Hickenlooper coating is prepared as follows: Bring kettle of tar (20 gallons) to a low boiling point, and add 20 pounds of fresh slaked lime, sifted over the top and worked down. Boil to a paste or consistency about midway between tar and pitch. Let it settle for a few minutes, then add 4 pounds of tallow and 1 pound of powdered resin. Stir until they are thoroughly dissolved and incorporated with the tar, then let it cool and settle. Ladle off into barrels. When ready for use, to each barrel of 45 gallons of the above mixture add 4 pounds of crude rubber dissolved in turpentine to the consistency of thick cream. Heat mixture to about 100° F., and immerse the service pipe heated to about the same temperature.

Capacity of Pipe.—All engineers who have undertaken the distribution of gas under the high pressure system have been surprised, and, in fact, dumbfounded, to find how much gas can be pushed through a small pipe. The writer would caution those who contemplate introducing a high pressure system to first study the formulæ for computing the flow of gas at high pressure. In so doing much money can be saved by laying the smaller sizes of mains, and just as good service is obtained. Many lean to the Pittsburgh formula, which has been proven about correct; but the author finds that by using Cox's gas flow computer (specimen exhibited) you come near enough for all economical purposes. The Cox, to his knowledge, is the only computer for this purpose in existence, It gives the writer pleasure to leave the specimen with your Association as part of this paper. Mr. Cox's formula on high pressure fluid discharge is as follows:

This computer solves the following formula, which is applicable to gas, air, and other elastic fluids flowing through long pipes with high initial pressures:

$$\left.\begin{matrix}\text{Discharge in cubic feet per hour}\\ \text{at atmospheric pressure}\end{matrix}\right\} = 33.3\sqrt{\frac{d^5 \times (p_1^2 - p_2^2)}{L \times w}}$$

Where d = diameter of pipe in inches.
p_1 = absolute initial pressure in pounds per square inch.
p_2 = absolute terminal pressure in pounds per square inch.
L = length of pipe in miles.
w = specific gravity of the fluid when air = 1.

Cox's Gas Flow Computer.—(For low pressures.)—This computer solves Professor Pole's well-known formula for the flow of gas in pipes.

$$\text{Discharge in cubic feet per hour} = c\sqrt{\frac{d \times (p_1 - p_2)}{l \times w}}$$

Where d = diameter of pipe in inches.
p_1 = initial pressure in inches water.
p_2 = terminal pressure in inches of water.
l = length of pipe in yards.
w = specific gravity of the gas when air = 1.
c = a constant varying from 1,000 to 1,350.

To Find the Discharge from a Pipe, and the Required Size of Pipe.

(1) Set the specific gravity of the gas opposite the selected constant.
(2) Bring the difference of pressure $(p_1 - p_2)$ opposite the given length of pipe.
(3) Opposite any diameter of pipe will be at once found the discharge in cubic feet per hour; and
(4) Opposite any desired discharge will also be found the required diameter of the pipe.

On this gas flow question, a letter the writer has from Mr. H. L. Rice, General Manager of the Western United Gas and Electric Company, of Aurora, Ills., may be quoted:

The Pittsburg formula, which is apparently the best high-pressure formula yet presented, is very interesting. I have been told that the curve of gas flow is the parabola, but have not gone into this. I do not think it is so. The most important point is, of course, that it is

absolutely true as the initial pressure increases in reference to any fixed final pressure that the gas transmitted becomes more and more in direct ratio to the increase in pressure. The amount of gas transmitted is directly as the square root of the differences of the squares of the two pressures, initial and final; and as the initial pressure becomes very great, the final pressure is more and more negligible in comparison, so that we have the amount of gas transmitted being directly as the square root of the square of the initial pressure. This is an important point, as it is the justification for increases in pressures, and will be the justification for very high pressures, if other considerations will allow us to come to them.

Further examination of the formula along these same lines show that you can transmit almost as much gas with a final pressure of 10 pounds as you can with a final pressure of a few inches of water; hence there is no increase in the cost of transmission lines in serving distribution centers with direct high pressures. This is an important point also, because if it didn't work out this way all the saving you might make in your distributing direct high pressure system you might lose in the line for transmitting gas to the center of distribution, and having to deliver it at a higher terminal pressure.

These are a few points which I think are interesting and would like to see elaborated. The Pittsburgh formula is standing the test of time and experience. Of course, more experiments would be of value. Such as we have, so far, show that this formula is right.

With regard to our actual work the last year or two, will say that our high pressure experience has been quite uneventful. We have had practically no troubles whatever, and have made no advancement in the art, except in some very mild particulars, such as little wrinkles. We have abandoned the stop cock entirely at the mains, believing this to be a source of weakness. We use the T-saddles; and we have our own device for shutting off the gas while laying the service. This is a small tool of which I send you a blue print. (Fig. 4.)

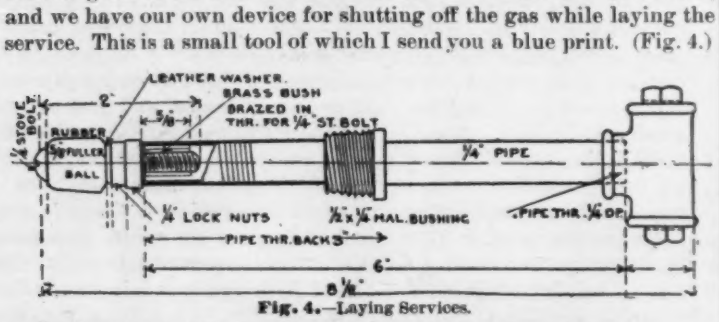


Fig. 4.—Laying Services.

Condensation.—We have started recently some experiments on condensation from compression, and I inclose you the result of these, although they are so preliminary that only the most general results can be drawn from them. There is condensation of water, as would be expected, and there is also some oil. This oil is a limpid, light colored oil, with a most powerful odor—that of drip liquor many times concentrated. It is highly inflammable, and can doubtless be used for enriching purposes, although we have not gone this far. Gas at comparatively low pressure will doubtless pick up this oil condensed at a higher pressure.

At Elgin we have a tank near the works. Occasionally the gas is passing at high pressure toward Aurora through this tank. Again, the gas is coming to the Elgin works from Aurora, and is consequently at lower pressure when it reaches this tank. Now, you will observe that the oil per thousand in the Elgin report is much less than in the Joliet report. The only reason we can give for this is that a large part of this oil, condensed at high pressure from the Elgin gas, has been reabsorbed by the Aurora gas coming to Elgin. Mr. Wheeler, of the Semet-Solvay Company, agrees in this conclusion.

Now in regard to the removal of condensation. You will recall that at Milwaukee it was not generally agreed that this problem had been solved. Nevertheless, I think it has, and that it is a very easy matter to rid the high pressure gas of its condensation within a reasonable distance from the works, so that no further deposit of water or oil need be feared. Of course, as the gas expands it begins to be in a position to absorb moisture. Therefore, the only problem is to shake out all the moisture that will go down at the initial pressure. The first experiments in this line were baffle tanks. Mr. Goodnow built one of these at Waukegan; and we built one on exactly the same lines, as already mentioned, at Elgin.

Last winter we had a lot of condensation develop on a new line to Dundee, and it was necessary to do something at once. The people all along this line were out of gas, and their services full of water. The thought struck me, Why not put in practically a steam separator? It occurred to me that this was simply a question of velocity, and that we should treat this gas just the same as we treat steam in freeing it from water. As the Cochrane is one of the best, I placed an ordinary 8-inch cross in this 3-inch line, connected the bottom of this cross into a leg below the frost line, and plugged the top of it with a plug to which I had fastened a plain sheet iron baffle, just like the baffle in the steam separator, only not corrugated. This little rigging cost only a few dollars, and cleared up the water trouble for good in that line. It was placed at the bottom of the first hill going out from the gas works.

You might make a point of the ease with which one can separate moisture from the initial high pressure gas, and that it can be done on the same principle as steam separators; and all that is necessary is to put one of these separators out on the line at the first low point beyond these lines. There will be no trouble beyond, as the gas will begin to expand.

Extent of High Pressure Work.—Replying to your inquiry as to the number of miles of main, and the number of consumers that we have, I beg to advise you as follows: We make a distinction between the pipe line and the high pressure distributing mains. We have the following pipe line in use:

Diameter. Inches.	Length. Miles.	Length. Feet.
8	16	3,920
6	20	274
5	1	4,823
4	51	345
3	13	4,483
2	..	3,130

High Pressure Distributing System.

Diameter. Inches.	Length. Miles.	Length. Feet.
2	9	323
1½	34	4,139
1¼	—	207
1	21	3,251
¾	3	3,672

As for the number of consumers, I do not know whether you mean direct high pressure or with high pressure gas. The subject is best covered in this way: We send more or less high pressure gas around to all our cities and towns—even those that have manufacturing stations and holders get some high pressure gas occasionally, if it is necessary to help out the stock of gas. All the works and holders are connected to the pipe line. So much for the 4 main towns—Aurora, Elgin, Joliet and La Grange, and also La Grange Park and Grossdale—which are served by low pressure from the La Grange works. Total meters in this group, 17,884.

	Consumers.
North Aurora is served by direct high pressure, and has	110
Naperville, by direct high pressure, has	430
Batavia, high pressure gas reduced through a district governor and low pressure distributing system	643
Geneva, the same	331
St. Charles, the same	587
Hinsdale, the same	595
Downers Grove, the same	482
South Elgin, direct high pressure	73
West Dundee	243
East Dundee	83
Carpentersville	52
Plainfield	191
Lockport	276
Western Springs	148
Wheaton	536
Elmhurst	280
Lombard	105
Glen Ellyn	239
West Chicago	335

Of course, you know our ultimate plan is gradually to consolidate all our manufacturing in one station; and when this is done, all the gas delivered will be gas that has been compressed, with the exception of the gas that will be delivered in the city where the big plant is located.

Boosting.—We are beginning to do quite a little reinforcing in our low pressure districts from the high pressure mains. In Aurora, for example, the pipe line comes into the city right through the heart of the district where the pressure is weak on the outskirts. We expect to wing out two 4-inch mains on each side of this pipe line right through this weak area, and set governors at various points to reinforce and help carry the peak load of the low pressure system. We have not yet decided on the governor to use. We have experimented with a number, and probably will have one of our own design made. As far as we can see ahead now, we will not depend on one governor,

but will set a bank of comparatively small governors in each manhole. I am not prepared to go into the reasons for this at the present time, nor are we far enough advanced in our work; but we do feel sure we are going to get some very effective boosting.

Of course, this idea of boosting with the higher pressures is not novel. I believe that they have used it most extensively in California. In the East, the tendency has been, I believe, to use lower pressures. In this connection, I will say that I heard the other day that the B. F. Sturtevant Company have now a very successful rotary blower on the market that is efficient at 10 pounds. You will remember that Mr. Baehr gave as the reason for using 5 pounds at St. Louis that they wanted to use rotary blowers, and these were not efficient above 5 pounds. It might pay you, therefore, to write the B. F. Sturtevant Company about this blower, I have been intending to go into it with them, but have not as yet had the time.

We do not know nearly enough yet about the loss in candle power and heat units in compressing and in transmitting high pressure gas. There is some loss, of course; and we know it is less with coal gas than with water gas. The oil above mentioned as squeezed out of our coal gas represents some candle power. We expect to make some experiments in this subject, but have them as yet before us, and, therefore, I regret not being able to give you some information on this important subject.

In general, I will say that an ordinary good quality coal gas can be compressed to 40 pounds, and delivered 50 miles to consumers and give satisfaction. I am speaking of the ordinary community using gas ranges and doing its lighting largely with incandescent mantles, but with occasional open flames. The open flames will not be as good as with the gas before compression; but they will pass. The heating quality will be entirely satisfactory. At pressures of 20 pounds, or thereabout, the open flames will be very little (if any) impaired. I am now speaking very generally, of course, for, as above stated, we have yet our accurate experiments to make.

I have written considerably at length, and have not managed to tell you very much. The principal thing is that we are going along successfully, and having no more troubles in high pressure distribution than in low - in fact, I do not think we have quite as many.

Elgin Observations.—High Pressure Drippage Data.—Station "D."

Duration of pumping Jan. 21 to Jan. 28 inclusive, actual time from high pressure charts	114 hours.
Gas pumped	1,237,301 cubic feet.
" per hour	10,850 "
Temperature of gas at inlet of compressors	65°
" " outlet "	..
Gas pumped. Coal gas and water gas.	

4-Inch Line South.

Gas pumped during period	1,095,901 cubic feet.
Clear oil from drip during period	80 gallons.
Liquor from drip during period	22 "
Condensation—total	102 "
" per million cu. feet of gas pumped	93 "

3-Inch Line, North Dundee.

Gas pumped during period	141,400 cubic feet.
Clear oil from drip during period	45 gallons.
Liquor from drip during period	11 "
Condensation—total	56 "
" per million cu. ft. of gas pumped	392 "
Condensation—both 3-inch and 4-inch lines—per million cubic feet of gas pumped	158 "

Joliet Observations.—High Pressure Drippage Data—Station "B."

Duration of pumping—7:15 A.M., Jan. 21, to 5 P.M., Jan. 24	81¼ hours.
Gas pumped by No. 1 compressor (new), 4½ hours, at 15,200 cubic feet per hour	630,800 cu. feet.
Gas pumped by No. 2 compressor (old), 73¼ hours, at 13,300 cubic feet per hour	974,225 "
Gas pumped during period	1,605,025 "
Temperature of gas at inlet of compressors—variation 68° to 74°. Average of 18 readings	70.6° F.
Temperature of gas at outlet of compressors—variation 180° to 217°. Average of 9 readings	191.0° F.
Clear oil from drip during period	157.5 gallons.
Emulsion of oil and water during period	104.4 "
Total condensation during period	261.9 "
Clear oil per million cubic feet of gas pumped	98.1 "
Emulsion per million cubic feet of gas pumped	65.0 "
Total condensation per million cubic feet of gas pumped	163.0 "

Remarks.—No regularity in amounts of oil and of emulsion per 1,000 cubic feet of gas, nor in relative proportion of oil to emulsion from day to day. Also a distinct difference noted in color of oil samples taken different days.

Services and Methods of Connection.—It seems to be generally agreed that for the sake of additional safety only beaded galvanized fittings should be used on the high pressure side of services, while on low pressure side all or anything found suitable for low pressure work may be used. Services on low pressure side of service governors are treated the same as low pressure services. A galvanized iron high pressure saddle (made by H. Mueller Mfg. Co., Decatur, Ills.) is bolted on to main, the joint between the saddle and the pipe being made gas tight by means of a lead washer, which sets into a recess in the saddle, and is furnished with a saddle. This saddle has ¼-inch wrought iron pipe thread holes in it, a ¼-inch beaded galvanized street T screwed into the saddle, and a ¼-inch by ¾-inch beadedga lvanized iron reducing street L put into the side outlet of the sfreet T to make the swing joint. A ¾-inch pipe is run to the curb, and one of H. Mueller Mfg. Co.'s heavy high pressure service cocks is put in at the curb. This cock has a bore at the bottom of the plug $\frac{3}{16}$ inch in diameter. The main is tapped with a hole ¼ inch through the ¼-inch street T. The service is then carried through the cellar wall and a lock meter cock is put on. A ¾-inch pipe is then run to the governor and safety seal. The vent of this seal is piped to a suitable place out of doors. Beyond the governor all the work and supply are treated as though a low pressure gas system were in use. When the gas blows the mercury safety seal it makes sufficient noise as it issues from the vent to attract immediate attention, and a whistle is not necessary.

Figs. 5 and 6 illustrate how the services are connected, and Fig. 7

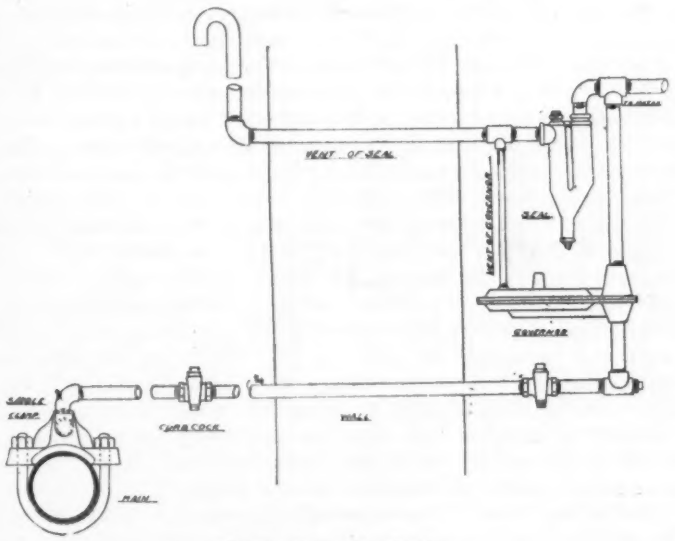


Fig. 5.—Connecting Services.

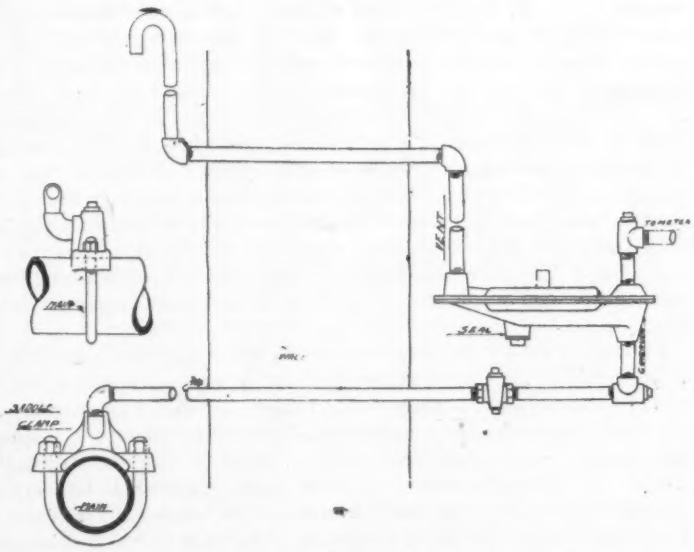


Fig. 6.—Connecting Services.

shows the character of the fittings used in service work. The latest method of connecting services—and one which the author thinks will now become standard—is to place on the main a service clamp or saddle, which has a top and side outlet, and is a T and service saddle in one piece. This does away with one thread, and gives a much stronger connection to the main. In this case the main is tapped

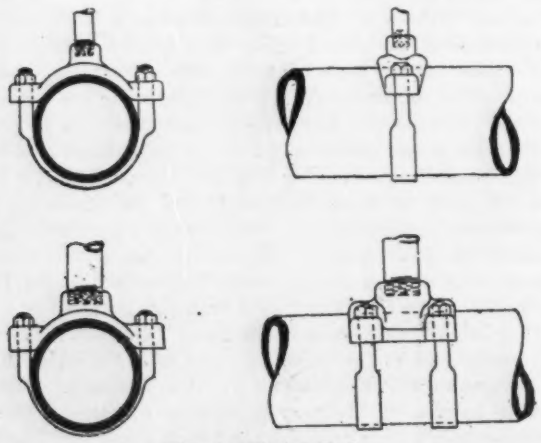


Fig. 7.—Fittings Used.

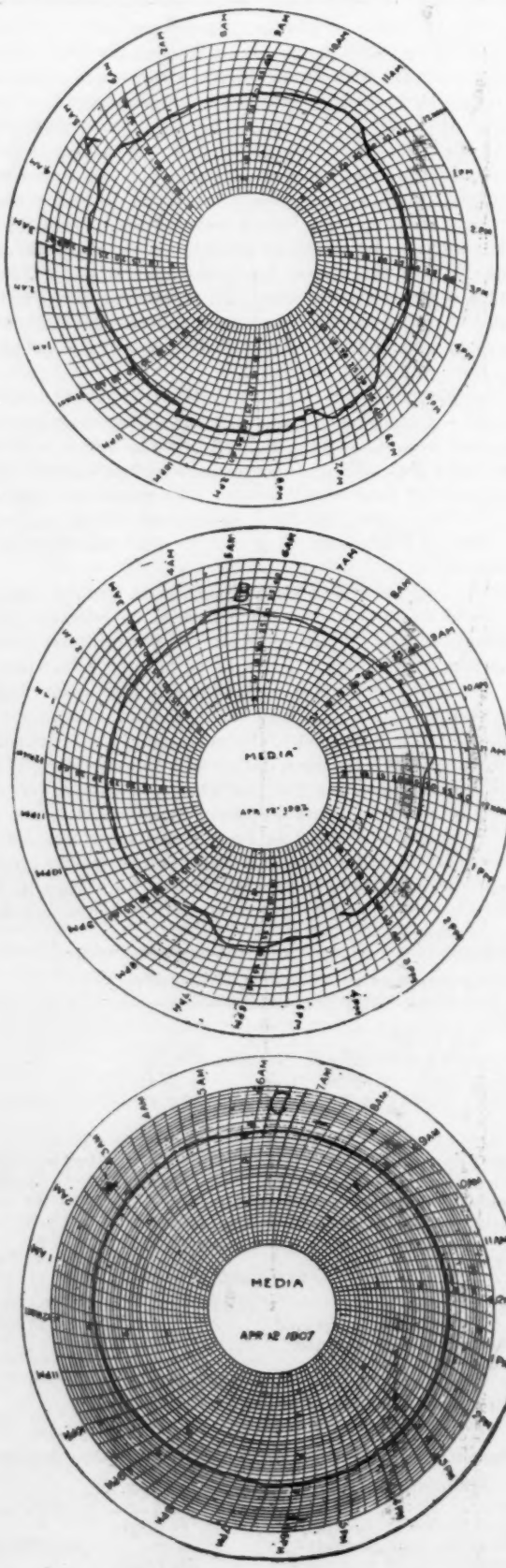
only $\frac{3}{16}$ inch, without the use of a corporation cock, a curb cock or an inside service cock, with the use of a ¾-inch cock with ¼-inch roundway in the plug only. This enables the blowing out of the service and overcomes the difficulty of stopped services, which gave some trouble under the old system.

If the stoppage occurs right at the opening in the main a force pump will easily blow away any stoppage that may accumulate there. There seems to be a tendency for particles of foreign matter to deposit in the services, which, in the old style service, were very difficult to get rid of, while with the small main tap much of it remains in the larger pipes or mains. Another decided advantage of the small hole in the main is that it prevents a large escape of gas in case of a broken service or of a broken pipe inside a cellar. A small hole in the main will not permit much more gas to pass than would in an ordinary low pressure service, and therefore gives a much more direct control of the high pressure. The author wishes again to call particular attention to Fig. 6, showing the latest system of connecting services.

Tapping Machine.—An interesting little device that is used in high pressure work is the tapping machine, and a sample of which is brought as a present to your Association. This is so simple and so ingenious that the writer did not feel it quite right to omit it. This machine is made by H. Mueller Mfg. Co., of Decatur, Ills., and much of the success in high pressure distributing work in America is due to their untiring efforts to perfect devices to help us to develop the business and to carry out the ideas of various engineers. The author would at once say he believes in giving full credit to all those who have done so much for the gas business at large.

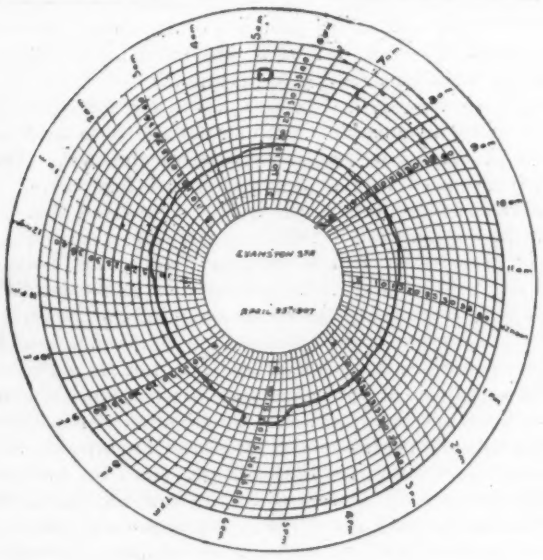
Service Governors.—Many types of governors have been offered for this purpose, but most of the engineers have settled upon three types, each of which will now be described: The Williamson governor, invented by C. W. Bradley, Chief Engineer of the Northwestern Gas and Coke Company, Oak Park, Ills., has the many advantages of earlier types of service governors and the additional advantage of combining the mercury safety seal with the governor body, which saves many small fittings and much time and cost in its installation. [Sample was exhibited.] The Reynolds governor is much like the Williamson, having its large share of admirers. [A sample was exhibited.] [The Reynolds double district governor was fully described.] As this was described and illustrated in the *Gas World* for the 23d February, 1907, it does not seem necessary to reproduce this part of the paper.] The Equitable governor is another type satisfactorily and extensively employed and is used with a separate mercury seal. [Sample exhibited.]

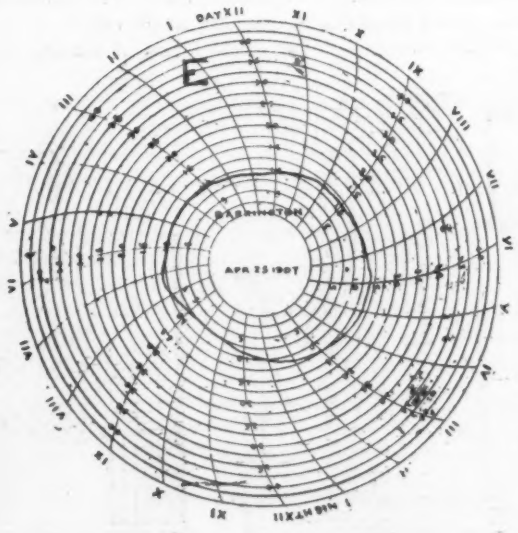
Charts.—To show the very satisfactory work done in high pressure distribution in the United States, the author wishes to call attention to the 7 charts submitted herewith. Chart "A" shows the pressure on the line at the compressor station at Chester, Pa. Chart "B" shows the pressure on a high pressure line 12 miles away at Media, Pa. Chart "C" shows pressure beyond the house governor at Media, Pa., 12 miles from compressor station. Chart "D" shows the pressure at the compressing station at Evanston, Ills. Chart "E" shows the pressure on the high pressure line at Barrington, Ills., 38 miles from the pumping station. Chart "F" shows the pressure or condenser side of Williamson regulator, 8 miles from the Evanston compressor station. Chart "G" shows pressure at the same point taken as a check, charts being taken 1 week apart. The results obtained, as shown by these charts, are most convincing. If the maintenance, etc., of a high pressure installation is calculated, the care of the governor and diaphragms must be taken into consideration. The writer certainly thinks the diaphragms need oiling periodically and systematically, and they should also be carefully inspected, for he believes the fewer services that blow the better the reputation of a high pressure system will be.

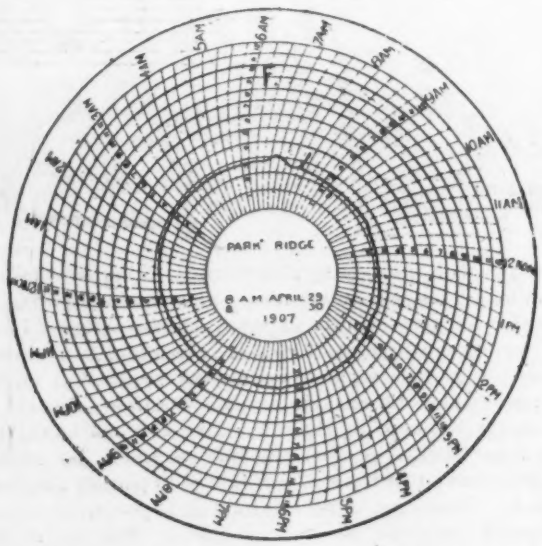


Of course, the safety seal or safety vent on a high pressure service is of the utmost importance. This vent pipe should be taken out of doors. The end of the pipe should not carry any threads, and should be out of the reach of everyone, so that it would be impossible for it to be plugged with a cork and a piece of wood.

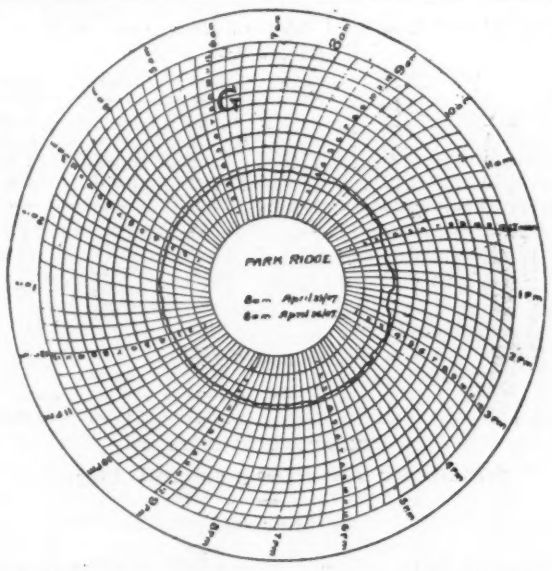
Compressors.—The question of which compressor to use is still under discussion by our best engineers. At 5 pounds to 10 pounds many prefer the rotary blower, single or tandem; above this, they jump right into any type of air compressor that can be adapted to gas com-







pression purposes. [To show the flexibility of the compressor situation, the author exhibited a photograph showing a Westinghouse air compressor fastened to the side wall of the exhauster room of the Northwestern Gas Light and Coke Company at Evanston, Ills, ; also a photograph of the same Company's large compressor for heavy duty. This cost about $200 installed, and supplies 38 miles of high pressure mains, on which they have 1,400 consumers. This compressor runs 24 hours per day, building up a pressure of 35 pounds, which drops to 12 pounds at the end of the peak load; the large amount of pipe acting, as it does in all cases, as a storage for free gas.] One could well afford, he said, to have 3 or 4 of these compressors in just any clean place in a small works, and have a perfectly satisfactory emergency outfit at a minimum cost of equipment.



Pulsation and Storage Tanks.—To those sufficiently interested to go into this section thoroughly, the writer would suggest the perusal of the paper on "High Pressure Gas Distribution of To-day," written by Mr. H. L. Rice, of Aurora, Ills., for the thirty-third annual meeting of the American Gas Light Association, held on the 18th October, 1905, which covers the matter so thoroughly that the author does not want to pass it over without calling attention to it. Present developments points to the further introduction of wrought iron cylindrical tanks at the extreme ends of the mains, which are used as holders to feed back on the peak load; and their great economy and usefulness must appeal to you all.

Loss in Candle Power.—For a long time nothing definite could be obtained on the question of the loss of candle power due to compression and transmission; but from recent investigations the writer is satisfied that this is a factor which must be reckoned with. Some very reliable data showing a drop of 11 per cent. at 5 pounds was observed for gas transmitted eight miles, which was about double the loss of candle power of the same gas sent out 8 miles on the low pressure system.

Complaints.—As a matter of great interest, the author quotes a letter received from Mr. C. W. Bradley, Engineer of the Northwestern Gas Light and Coke Co., Oak Park, Ills., in regard to a particularly severe winter. Considering the climatic conditions referred to, the record, it will be admitted, is a most excellent one.

The inclosed records of complaints are *all* the troubles we have had on the line between the given dates. You will find on the inclosed sheet the size, mileage, and number of services in the territory covered by these complaints. You will notice that there are no leaks at the expansion joints, and that the total number of complaints is small compared with the territory supplied.

Record of Complaints received on Evanston High Pressure Line from Madison Park to Barrington, from 22d December, 1906, to 19th March, 1907.

Broken curb cock	1
Changed location of service	3
Loose saddle	19
Leak at long screw	1
Pipe punctured	1
Core of curb cock loose	1
Leak at coupling	2
Street T broken	1
Service sagged	1
Regular leak	3
Williamson 2. Equitable 1.	
Regulator valve frozen	4
Williamson 2. Equitable 2.	
Regular valve dirty	4
Equitable 4.	
Leak at regular diaphragm	2
Equitable 2.	
Regulator valve broken	1
Equitable 1.	
Water in regulator—service sagged	1
Regular diaphragm worn	1
Equitable regulator 1.	
Poor supply—air vent stopped	3
Equitable 3.	
Total	49

Record of Mains Laid and Services Run from Madison Park to Barrington.

Town	¾-inch. Feet	2-inch. Feet.	4-inch. Feet.	6-inch. Feet.	Services
Madison Park	—	16,589	—	6,552	83
Park Ridge	—	34,154	—	6,388	342
Main Township	1,711	61	24,033	14,854	—
Desplaines	—	27,792	6,489	3,591	347
Feehanville	376	622	—	—	4
Mount Prospect	271	1,811	—	—	16
Elk Grove Township	—	—	8,908	—	—
Arlington Heights	—	30,212	14,616	—	6
Wheeling Township	—	—	11,194	—	272
Palatine	—	16,741	5,679	—	158
" Township	—	—	38,777	—	1
Barrington	—	24,349	—	—	208
" Township	—	—	3,629	—	—
Total	2,358	152,331	113,325	31,353	1,437

Pneumatic Air Pressure and Lights.

By "ENGINEER."

I see they are doing considerable towards developing pneumatic power for use in connection with lights in houses, public buildings, hotels, shops, mills, stone working plants, greenhouses, etc. The idea originated some years ago with the application of the hand-power and foot-power air pumps of bicycles and automobiles. The use of the pumps for this purpose was to fill reservoirs of oil or gas about half full of the material to be used, following up with the discharge of compressed air into the body of the tank. The pneumatic system on a more elaborate scale consists in pumping air into a tight tank, compressing the air within the latter, which pressure is exerted on the body of material within, whether it be oil, gas or other illuminant. The fact there is a pressure on the contents of the tank means that the force at the outlet will be greatly increased and the vapor lights can be produced. In these lights for houses, shops and other places the illuminating oil, gasoline, alcohol or other ingredient used is simply confined under pressure in a retort. This retort may be a very small affair, resting upon a table, or it may be specially constructed to the size of a boiler of more ample proportions, as shown in Fig. 1. The small amount of air pressure obtained in the small tanks can be used to advantage in producing the illumination. In the case of lights for picture machines, spot lights for theaters, exterior lights for night work in streets, or for interior or exterior show window illustrating, outfits of small-size are often used, the necessary air pressure being acquired by means of the ordinary wheel-tire pump; but for greater work the pneumatic system is advisable. In the figure in which the outfit is shown the arrangement of piping can be traced. The object is to close all of the outlets, then pump in air after the body of liquids for burning is admitted. All of the outlets are securely closed as soon as the oil, gas or other material is run into the tank. Sometimes the gas is made on the premises and it passes into the tank under its own pressure. Carbide gas is being made in this way and then admitted to the tank. Then there are chemicals employed for generating hydrogen or oxygen gas for compression in storage tanks. The plan involves the compressing of a certain bulk of air on the contents of the tank, thereby creating a pressure on the same, which pressure can be utilized in the production of certain lights. In the making of the gasoline oil vapor lights for arc lights for show windows, exterior night work or apartments of any kind, compressed air is used to very good advantage. In the experiments it was found possible to admit a liquid, and by introducing the air under pressure through a pipe below the body of the liquid, that the air would pass through and become compressed above. In some cases the air is pumped in from above or through the side. There is no material difference as to the manner of entrance.

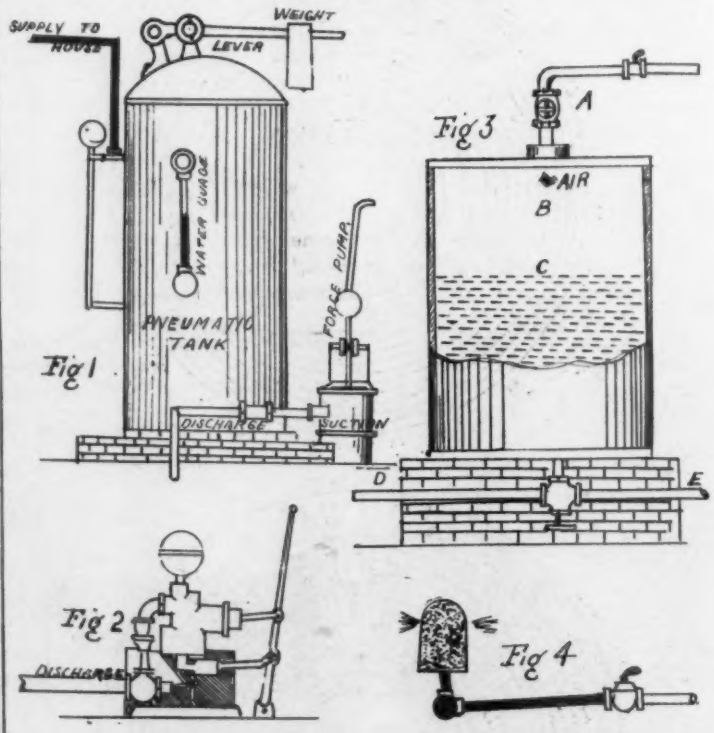
Fig. 1 shows a general view of one of the air compressing tanks. These tanks are constructed of boiler material, and the laps are, or ought to be, securely united.

It is possible to secure considerable pressure on the gas, oil or other material within. After the tank is properly installed the force pump is put in. This force pump is of the common pattern procurable at any dealers. The pump is fitted firmly to the base, near the bottom of the upright tank, where the workman can operate the lever for pumping the air into the tank. In some cases this work is performed by power and considerable labor is saved. However, even with the hand power lever, the operation of filling the tank is not very difficult. The air is taken in through the suction pipe and forced along the adjoining pipe from the pump into the pneumatic tank. I saw some of these tanks constructed on the principle of the water tube boiler, with regular tubes and a head; but, as a rule, the tank is simply a plain reservoir for containing the liquid gas and air.

There is a water gauge on the tank, so-called for convenience, because it is really a water tube; but in this case it is used to measure the depth of the oil or other body inside the tank. The device should be furnished with a properly fitted safety valve, consisting of the valve and lever bearing the weight. I noticed that very many of the outfits were lacking in this factor of safety, depending upon a surplus of pressure to evince itself by making the oil or gas ooze through the gaskets and valve connections in season to warn the workmen. But with the gauge for determining the pressure, fitted to the side of the tank as shown, connected with the pipe leading to the house, you can determine the pressure in the tank at a glance.

Fig. 2 is an outline of the set up of the force pump. A detailed explanation is not necessary, as these pumps can be purchased ready for connecting up and operating. Fig. 3 shows an interior view of the tank with a flat top, differing in this respect from the first mentioned tank. The line of body, *C*, represents the material which furnished the composition for the light. The air is pumped in at the top through the pipe, *A*, into the void, *B*, or it may be admitted through the bottom or through the sides as before intimated. The discharge pipes on either side, *D* and *E*, are as represented in the cut.

In Fig. 4 is shown one of the typical forms of mantle burners used



in connection with the making and burning of kerosene oil, gasoline oil or common house gas on mantles. This plan of lighting has been introduced with good results in many places. Hence, in order to employ the air pressure contrivances in relation to the pressure on substances for ignition, the only equipment required is the tank, the force pump and pipes for receiving and distributing material to the jets. These jets may be put about the shop, the house, the bank, the hotel, the store show window or other places as required. As to the degree of pressure, some adopt the uniform rate of 10 pounds air pressure per square inch. Others get better results with 15 pounds per square inch. Much depends upon the general conditions. The plan of the plant, the nature of the material for distribution, the character of the lamps to be fed, etc., have to be figured upon.

Common house gas has received a great advance in the industries during recent years, because of the advent of special devices for improving the blast, the heat, the power, and other factors aside from the light. With the possibility of getting a sun rival, or practically a pure white light with common gas, and with this form of light cheaper, steadier and more reliable than some of the more modern forms of lights, the future of gas in the lighting field is getting to be more and more enlarged. Of course, many of the trials of various devices fall flat. Nevertheless, something is learned and something is acquired with each failure. With many minds working at this project of bringing ordinary gas light up to date, greater things than

already accomplished may be expected. It is this competition with the electrical light people that inspires us all into striving to keep pace. In doing this we often get ahead; therefore, let the good work go on.

Light at the Jamestown Exposition.

By Mr. Felix J. Koch.

Here and there, at the Jamestown fair, there are some things of interest to those whose lines run to light.

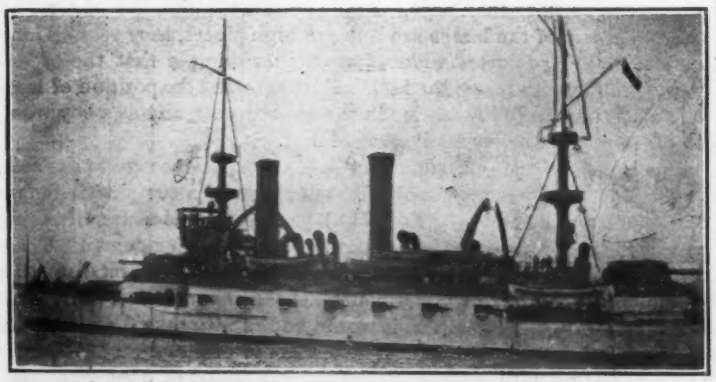
In the West Virginia Building, among the Alaskan relics shown, is a queer lamp, consisting of a mere bit of wick set in butter or tallow, and surrounded by three pieces of cork. Floating wicks, set upright on disks, and then sucking up bear or fish oil, for use during the long winter night of the Arctics, are likewise here.

As part of the silver service presented the battle ship Georgia recently, and on exhibition in the Georgia State Building, there are two great candelabra, of two tiers of three prongs each, which attract for the dainty filigree to their red covers. These cluster about a massive central candlestick with seals set about its base and a pine design cut on the pedestal, which rests on a base of Georgia marble.

Night on the "War Path" is particularly pretty in the section of the "Streets of Cairo," where looking back one sees the minarets lit up and the brown porches outlined with electric lights as they are in the Ottoman Empire on the occasion of great feasts alone.

Impressive in the "Destruction of San Francisco" are the lights coming into the homes and upon the bay as evening sets in on the doomed city. The illumination of this spectacle is little short of wonderful.

On a first arrival at the Exposition one is most impressed by the sight of the assembled warships of the world, lit up one and all, their names set out in electric lights, and masts and cross pieces illumined in the same yellow lights give the name, the "New Jersey," "Rhode Island," Virginia," and the "Georgia," while red lights deck out the sides. The minor fleet in the Roads, too, has its illuminants, while the



Chamberlain across at Old Point is likewise lit up. Some of the great ships have lights all about the bow as well as high up on the masts and the reflection of these in the water is decidedly pretty.

At the "101 Ranch," great electric lights in the arena seem strangely incongruous for a spectacle of the west of old Indian times. A display of various electric lights, and of the signal lights of a New York concern, are made. The greatest teapot in the world, a little room, in fact, inside the giant pot, is lit up with electricity, although Japanese lanterns hang tastily down from the lid. The pot would hold, if filled, 5,000,120 cups of tea.

The Candle Power Value of Daylight.

It has been frequently stated that the human eye cannot long bear without fatigue and irritation the direct light rays of any luminous source, if its intrinsic brilliancy exceeds 5 or 6-candle power per square inch, and some corroboration of this is found in one's ordinary experience of different means of artificial lighting. Candles, opal-shaded lamps, and most flat flames, have intrinsic brilliancies lower than 5-candle power, per square inch of luminous surface, and are not found particularly fatiguing. The direct rays of an oil lamp or an Argand burner, and some frosted incandescent glow lamps having from 4 to 8-candle power brilliancy, are perhaps just bearable. On the other hand, incandescent gas burners with from 20 to 25-candle power per square inch, inclosed arcs of some 100-candle power, incandescent electric lamps of 200 to 300-candle power, and Nernst "glowers" of probably 1,000-candle power, are far above the suggested maximum of 5-candle power per square inch, and require more or less shading to bring them within the physiological capacity of the retina. Obviously, the greater the brilliancy the greater the need for protecting the eye, even if waste of illumination result from the shading. Notwithstanding this fact, further advances in the production of high power lights will probably be made, finality not having yet been reached. Man may have evolved sufficiently to endure brilliant illumination which would have ruined the eyes of his earliest progenitors. Throughout the ages, however, he has blinked at the direct light of the sun, estimated at 600,000-candle power when at its zenith, and 2,000-candle power on the horizon; and even now, in spite of his evolution, the mere reflected sunshine of a bright day is frequently too much for him. Reading or writing in the open air under a dull sky is often no more than he is physically capable of enduring.

The natural light to which the human being has been so long accustomed affords, perhaps, a guide to his requirements in the way of artificial illumination, and Prof. O. H. Basquin has recently performed a useful service in bringing before the readers of the *Illuminating Engineer*, and indirectly others, some data as to the candle power value of ordinary daylight. The experiments of which he gives particulars were made in Chicago and lasted over 2 years. The light from the zenith sky was chosen for examination and measured through an opening in the roof over a factory top floor, where the photometer was situated. The opening was 8 or 9 feet above the photometer flicker screen, and the comparison was made with an incandescent lamp sliding on the bar—the lamp being frequently checked against a Hefner standard lamp.

The kinds of sky were arbitrarily divided into five classes—viz.: (1) Clouds, no blue sky, no sun, storm present or near. (2) Overcast, no blue. (3) Clouds predominating, principally cumulus. (4) Blue predominating, clouds generally cirrus. (5) Cloudless, either clear blue or hazy. The figures of brightness for each class are given by Prof. Basquin in candle power per square foot, rather than per square inch - the unit used for artificial illuminants. The comparative values of day end artificial light can, however, easily be obtained by using the divisor 144 for Prof. Basquin's figures.

Three tables are given, showing the monthly mean brightness of the sky at 9 A.M., 12:30 P.M., and 4:30 P.M., respectively. These indicate considerable differences, not merely between the classes, but also in the results obtained at various times of the year and hours of the day. The mean figures, in candles per square foot, of the 2 years' tests, irrespective of season, for morning, midday and afternoon, are extracted as under:

Time.	Class 1.	Class 2.	Class 3.	Class 4.	Class 5.
9:00 A.M.	180	560	720	485	320
12:30 P.M.	310	960	750	590	460
4:30 "	196	620	560	435	310

From these figures it may be seen that the average brightness of the day for each class is as follows: 229, 713, 677, 503 and 363 candles per square foot.

It is curious to note in the full tables that more light was received per unit of area opening in Class 2 with the overcast sky than in Classes 4 and 5, when clouds were practically absent, though it is obvious, as Prof. Basquin suggests, that the atmospheres in the latter classes were too clear to allow light to diffuse.

The tables disclose considerable variation in results, dependent upon the period of the year. To take 2 months only, in the case of the morning tests, the mean figures, irrespective of class, were for January 185 candles and for July 735 candles per square foot. At midday the figures for these 2 months were 325 and 925 candles, and at 4:30 P.M. 27 and 300 candles per square foot respectively. The contrasts in any one class, however, may be still greater. The author himself draws attention to this when he states that mean observations in Class 2 for December fell below 200 candles, while those for June were above 1,200 candles. From the results and tabulated figures, Prof. Basquin calculates that the mean annual brightness of the zenith sky at Chicago is about 500 candles per square foot, which nearly agrees with the average of the daily brightness figures of all classes extracted as above.

A curve is drawn showing that the mean brightness for each hour of daylight closely approximates to the curve of sunshine percentage over the same time, and the following equation is given from which the mean hourly brightness of the sky may be calculated from the mean percentage of sunshine for that particular hour: B (mean

brightness) = 20 (mean percentage P — 35). A second curve is added indicating a similar relationship between the mean daily brightness of any month and the mean percentage of sunshine for that month; the equation in that case being B = 20 (P — 30).

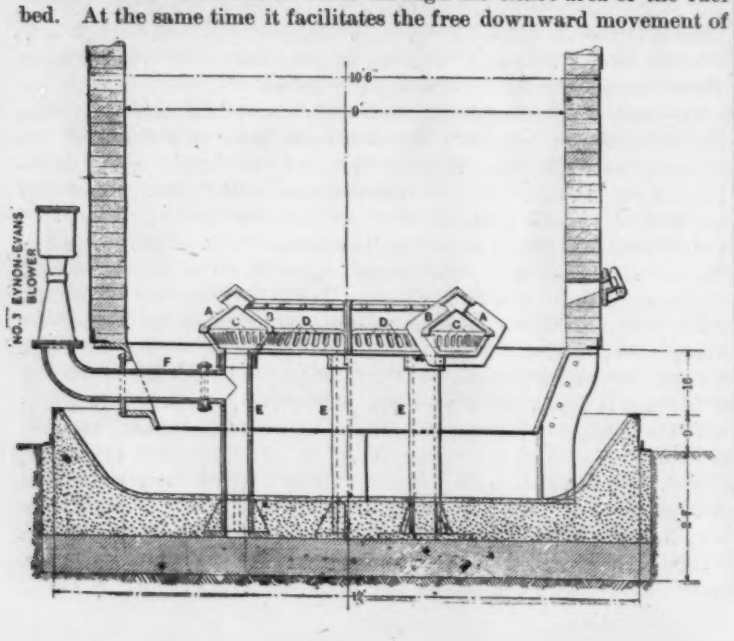
While Prof. Basquin is careful to point out that the above figures have been experimentally obtained for Chicago only, he tentatively assumes that they are of general application. It is accordingly suggested that the average sky brightness of other places may, with the help of the second equation, be deduced from the sunshine records. Thus at Buffalo the percentage of sunshine is stated to be 50, and the equation therefore works out to 400 candles per square foot as the average sky brightness. The author gives from 25 to 30 as the percentage of sunshine for British towns; but, evidently prompted by the inadequacy of the equation in this instance, he remarks that the difference between the British percentage and that obtained in the States may possibly be accounted for by the different types of instruments used in taking the records. His figures for British sunshine are, however, too low.

Dealing with the variations from the average brightness, the writer points out that while at times the brightness may run up to double the average value, it as frequently drops to half; and it is then that the daylight illumination of shops and offices becomes troublesome. He adds that, in view of the latter case, 250 candles per square foot of opening, or half the average figure, may be taken as a safe working sky constant,

The figure of 250 candles per square foot, or say 2 candles per square inch, is low compared with that of most of the present day artificial illuminants. The daylight effect, however, is undoubtedly better and to be preferred. As already shown, it is subject to considerable variation according to the weather, the season and the hour of the day; but its variations are, so to speak, on a low scale, to which the human eye can easily accommodate itself. In any case, it would appear that its greatest intrinsic brilliancy per square inch is not so high as that of an unshaded incandescent gas burner, and it is much lower than an electric lamp. The virtue of daylight probably consists in the fact that it is even in character and that what it lacks in intensity per square inch it more than makes up in quantity. Hence the eye is not unduly fatigued or irritated, as it easily may be by some artificial unshaded luminous sources. Dr. Steinmetz, following others in the same strain, drew attention to this in his paper on "Light and Illumination." For most high power lights, indirect rays by concealment or diffusion by globes are of absolute necessity, if the eyesight is to have any consideration. In the case of globes, probably an intrinsic brilliancy of 2 to 3 candles per square inch of surface, leaving out of the question for the time being the physiological effect of color, will give something in intensity very nearly akin to daylight, and, assuming no great loss of the original candle power is incurred, it should prove satisfactory.

A Device for Uniform Blast in Gas Producers.

Iron Age says that Mr. W. R. Miller of the Forter-Miller Engineering Company, Pittsburgh, has recently devised an improvement upon the gas producer of that Company calculated to give uniform distribution of the steam and air blast through the entire area of the fuel bed. At the same time it facilitates the free downward movement of the ashes into the pan. The view given is of the lower portion of a Forter-Miller producer, which is equipped in the usual way with a water seal basin, in which the ashes accumulate. The recent improvement consists in the provision of a windbox, consisting of a hollow ring concentrically located and of triangular cross section through one side. The outwardly and inwardly sloping faces *A* and *B* are so arranged that the ashes pass down and to the outside and inside of the windbox. The latter is composed of a number of sections bolted together through flanges, and the slanting walls *A* and *B* have interlocking joints, so that the series of sections are rigidly connected. The ports through which the air and steam are supplied to the fuel are shown at *C* and *D*. The windbox is supported on standards *E*, made of hollow pipe, and the supply pipe *F* connects with a blower. The gas maker can control the supply of air and steam, so as to force more or less air to the grate, according to the nature of the fuel or the quality of gas required.



Where the producers are of large diameter a number of concentric circular windboxes may be utilized.

[Proceedings; Furnished by the Secretary.—Continued from Page 53.]

THIRD ANNUAL MEETING, IOWA DISTRICT GAS ASSOCIATION.

Held at Cedar Rapids, Ia., June 12-13, 1907.

Second Day—Morning Session.

The President called the meeting to order, and announced that the next thing in order was the paper by Mr. J. C. Grey, of Des Moines, Ia., on

GAS ARC MAINTENANCE: METHODS AND RESULTS.

[For the text of the paper by Mr. Grey, see Journal, June 24, p. 1059.]

Discussion.

Mr. Martin—Mr. Grey says it is preferable to have older men clean these lamps rather than boys. I take issue with him, for the reason that, as many of the lamps are hung in high places, they require more or less climbing to get at them, and another thing is that the older a man is the more he feels the fact. He thinks that the position of lamp cleaner is about the lowest one in the gas business, and as a boy won't think so you get better results out of him.

The President—Mr. Martin, what is your experience as to the cost?

Mr. Martin—I never figured it myself; but, by a computation made in the office, it came to $3.82 per lamp per year. The matter of taking arc lamps out in summer, on account of the heat they generated, was looked up, and I found that less than 5 per cent. of the total number of lamps came back to us. Of course, the like would not follow all over the country, but with us it would be better to take that less than 5 per cent. down than to make a general rule of supplying all lamps that we had up with free maintenance for a period of 3 months. We have been told that the cost of maintenance has gone down as low as $3 per lamp per year with some companies. We have a very efficient man over our boys who clean these lamps, who keeps pretty close track of everything. When this matter of our cost of $3.82 came up I paid a little more attention to it, and I don't see what the Omaha Gas Company could do to lower that charge and do efficient work. If you half clean an arc lamp you ruin its reputation. You have to spend the time on it and furnish mantles when they are necessary, and if you do all of the things required I don't see how $3.82 is going to be reduced as a fixed expense.

Mr. Waring—I will add a little to what Mr. Martin said to prevent a wrong impression. These young men are not employed for economy; but they are boys. We pay them $2 a day, against $1.75 for men that Mr. Grey speaks of. None are under 21 years old, so that they wouldn't come under the child-labor law.

The President—Mr. Maple, can you tell us something about this kind of work?

Mr. Maple—We have only 375 to 380 arc lamps. We charge 50 cents a month for maintenance of indoor lights and make a little money on them, but in windy weather we lose something on the outdoor ones. I don't know how we will come out at the end of the year, but so far in the last 6 months we find that we are a little ahead at 50 cents.

The President—You are sure you have included all costs?

Mr. Maple—Yes; we have charged the actual time of the young man who takes care of the lamps. He keeps track of his hours, the

mantles and everything used in cleaning them. We have had more or less trouble on account of the wind with outside arcs. A great many people want a light beyond the awning, and although we brace he pipe, that did not overcome the vibration during a wind storm. Some time after a wind storm we have had to go fix every outside arc we had.

Mr. Haines—I would like to ask what size connections he makes.

Mr. Maple—We use 1¼-inch pipe.

The President—Mr. Crawford, can you tell us something?

Mr. Crawford—We have out about 425 arcs, and the consumers own every lamp. We have a man who trims the electric arcs; he also takes care of the Humphrey arcs. We inspect all every 2 weeks, and charge 50 cents a month maintenance wherever they want it, and where they don't want it we charge them for the supplies.

The President—Do you get as much as cost for your lamps?

Mr. Crawford—We sell the lamp complete and get pay for every one set.

Mr. Pratt—I would like to ask the gentleman if, where the purchase of supplies is left to the consumer, the lamps receive proper treatment, or the kind of treatment they get when the company takes care of them? It seems to me this optional purchase of supplies and maintenance is a disadvantage.

Mr. Crawford—We don't sell all of the lamps that are installed; the gasfitters sell arc lamps too. When we learn of a prospective gas arc lamp consumer we go to him and see what he wants, and if we can land him for the arc light supplies we do it; if we can't somebody else does. If a plumber or gasfitter gets the business he usually sells the supplies, although we call on the consumers and ask them if they want us to maintain them. However, we inspect all lamps every two weeks, and have our men ask if they want any supplies or renewals for the lamps, and if the lamp is not working properly he adjust it.

Mr. Chubb—We seem to have a little bit different scheme from most people. We sell our lamps outright, maintain them free forever, and we divide our lamps into three classes: 'Phone, monthly calls and weekly calls. Lamps used constantly are called on weekly. Our maintenance cost last year per lamp per call was something like 25 cents, and we average on the total number ef lamps 2.25 calls per lamp per month.

Mr. Clabaugh—I wish we could all agree on the price of arc lamps. We don't have any trouble to get $12 for inside and $17 for outside arcs. We maintain them free for 1 year; after that for 25 cents a month. Where we don't sell them we charge 50 cents a month for those inside and 75 cents for those outside. So we really get paid for the arc lamp at this in 2 years, but still it belongs to us. We may be all wrong, but we are getting out a good many lamps. Of course, the local conditions make a great difference as far as competition in electricity is concerned, and I think we have about as keen competition as any other place in the country, and while I don't expect the other works to help us sell our arc lamps at $12, sometimes the proposition comes up that "we can go to this town or that town and buy them for less than $12 and bring them here." If we all got together we could help each other out on that proposition very much. We are too far apart, and some of us are wrong.

Mr. Crawford—I will say in regard to the charge for lamps that we have (as does everybody, I suppose) gasoline competition, and while we have but one plant in Clinton, all but one store use gas and electric light. It would be impossible for us to get $12 for a lamp, because they would put in an air burner or some other form rather than pay that much for a lamp.

Mr. Haines—How long have the gasoline lamps lasted?

Mr. Crawford—Until we got after them and got them out.

Mr. Haines—The reason I asked Mr. Crawford that was because I wanted to find out whether the gasoline lamps had caused any trouble to the gas company. We have had in Des Moines a man representing the Pitner system, to burn 95 per cent. air and 5 per cent. oxygen. (Laughter.) He put a few plants in various stores there. Some of our salesmen came in great distress to find out what they should do—whether we should meet any competition. After talking the thing over we decided to simply stand pat on our proposition, and the first time we came across a second-hand plant we would go around and offer it to a prospective buyer of a new gasoline plant. We didn't have to wait 2 weeks for an opportunity, and as soon as we presented the proposition to the prospective consumer of gasoline he bought an arc lamp. There has been no real competition from that source, because the system is not mechanically well constructed, and it can't last. It is only a temporary proposition.

Mr. Hinds—I wish to state our experience at Le Mars. We began selling the lamps at $10 each, charging them for repairs and cleaning them up once a month. We have lately adopted a plan of furnishing the arcs and then attending to them, charging the consumer with mantles and globes or anything breakable about the arc. We found much better results from that method, and I don't see how we could ever go back to charging for the arcs. We have strong electric light competition and stronger gasoline competition in a small town of about 6,000,. One year ago there were something like a dozen individual gasoline plants lighting stores, and of course that cut out the gas company considerably; but I think still more so on the electric company. We have been routing them out from time to time, and have them now down to about 6, and we think we will get them out. The drug stores, which use more light than any others, are the ones who use the gasoline plant. Of course we can't furnish gas as cheap in Le Mars as in larger towns. Our price is $1.33. We have a few outside arcs. They give us a great deal of trouble in wind storms through breakage of mantles, and they are a great deal of bother. I think myself the outside arc is not really a success.

Mr. Stewart—Replying to the gentleman from Des Moines as to the success of gasoline plants. We are located at Waterloo, and I doubt very much if another town or city in the State has had more gasoline plants. A year ago we had something like 50 stores in Waterloo using gasoline for lighting, and I am glad to say we haven't over 5 or 6 left; but those 5 or 6 give an excellent light, and they have been in operation for 6 or 8, possibly 10 years, that are giving entire satisfaction. The cost, when gasoline is at its normal price, is cheaper than to operate an arc light at $1 per 1,000 for gas. That is strong competition. We found after putting in the Humphrey arc, where they had been accustomed to this gasoline light, they objected to the bills, and we couldn't hold our business; so it was up to us then to do something else, and we got hold of the harp light made by the Welsbach people. It has been very successful from the point of holding the consumer and satisfying him with the light, but our maintenance department has objected to it. They tell me it is just about as expensive to take care of a 1-mantle harp light as it is an arc light; but the new business department doesn't always look at it from that standpoint. We know we are holding the business with a 1-mantle light. Our plan has been to rent them at 20 cents per month per light, but not put in less than 2 lights at any place. That gives us 2 lights to maintain when we go to the store. I would like to know whether any of these gentlemen have had any experience with 1-mantle lights.

Mr. Hinds—Yes. We have taken out a great many arcs and put in the No. 6 Welsbach and the No. 5 with the steel shade, and in billiard halls and for store windows we find much better results and the bills not so high. We put them in the same as the arc, go around to clean them and attend to the breakage of chimneys and mantles.

The Secretary—Regarding gasoline competition, if, as Mr. Stewart has said, these gasoline outfits were in use for a number of years, one answer to it is there must have been in the employ of the concern a good mechanic, because they will not stay in order unless carefully attended to. I have in mind installations in club houses, etc., beyond the line of gas mains, which have had so much trouble with gasoline that they have installed kerosene lighting, simply because nobody was on the ground who could take care of them. Of course, one way to attack the gasoline competition is by opening up the question of fire insurance losses by gasoline. This, however, is open to several objections. To go back to the question of gas arcs, I think I am safe in saying that Des Moines has a larger percentage of them in use, in proportion to the number of meters, than almost any other city of its size. We have about 1 arc to every 6 meters installed. About a year ago we started after the gas arc business scientifically, making up our minds that they could be sold and installed at a reasonable profit, and could be maintained at a cost low enough to satisfy all of the consumers and come pretty nearly splitting even on the results. The thing has worked out about on the line Mr. Grey indicated in his paper. The installations have increased nearly 200 per cent., and we are about even on cost of maintenance. We have two methods of maintaining the arcs, one in which a fixed rate is paid per month, and the other, as indicated by some others of the members, is that of allowing the consumer to pay retail cost for the supplies used. Both methods have been very satisfactory, the supplies used under each method being about even. Regarding maintaining outside arcs, if there is a long spell of windy or inclement weather we miss those and allow them to go over. Everyone knows if we trim in stormy weather we are apt to lose the mantles. Otherwise they are taken care of the same as the inside arcs, and anyone going through Des Moines on a

Saturday night, when everything is lighted up, will be satisfied that the maintenance condition of the arcs there is about as good as in any other place.

Mr. Stewart—In reply to the remark that we have tried the insurance plan, we have hunted up the owners of each of the buildings having gasoline lights in them. We have taken the matter up personally with them and have written letters calling their attention to the reports of the insurance boards throughout the country, but we have had no results from those letters except in the case of vacant buildings. I can readily see that when a man has his building rented for 3 or 5 years he would not dare tell the tenant what kind of light he must have. At Waterloo we maintain the first arc at 50 cents, the second at 40 cents, the third at 35 cents. That makes $1.25 for three lights. All lights over three are 25 cents per month. In regard to the number of lights, we have over 600 inside arcs in Waterloo. We find the users are all well pleased, and even the gasoline people where we put in an arc don't object to the light, but it gives them more light than they want to pay for. The question is, will they ever get rid of these 1-mantle arcs? We want to get the arcs in place of the single mantle arcs, and that is a problem with which we have to contend. Some of our consumers who have been well pleased with the arc want to change to this 1-mantle arc, and it is a serious question how to prevent them from changing.

Mr. Maple—We have Mr. Vincent beat a little bit on this arc business. We have 1 light for each 3.3 meters.

Mr. Martin—What percentage of all outside arc lamps that Mr. Vincent has out are placed on outside cast iron or gooseneck posts, and what consideration they get per month or how they furnish them to the consumer?

The Secretary—We have 5 on outside posts, and those installations were sold complete. We sold both the post and the lamp to the consumer.

Mr. Martin—I thought you had a great many. I was given to understand that the entire central portion of the town was covered with this sort of illumination.

Mr. Haines—I can answer by saying that an ordinance of the town prohibits the erection of those posts.

Mr. Goodnow—I think Mr. Vincent is correct on the point in regard to the maintenance of gasoline arcs and that their retention depends almost entirely on the mechanical ability of the people selling and taking care of them. It does not appear to me from my observation of several plants that the price of gas has much to do with it, or the price of maintenance either. I have noticed in my own experience some towns where the price of gas is as low as 80 cents, and the Pitner lights were very flourishing; also in other places where they sell gas at $1 with a very low maintenance charge. If the people try to maintain them and do not have complete supervision they will put them out; but if they are well maintained and taken care of they are going to stay in a long time. In one or two towns that I have had under close observation, with gas at $1 and arc lights at a very liberal maintenance charge, I am ashamed to see how many gasoline lights there are; but I observed that they are very well taken care of. Some of them have been in use 3 or 4 years and look about as well as they did when first installed. In other cases they have been thrown out because of the annoyance, not because of the expense. In another town in the Southwest, with which I am familiar, they charge $1.50 for gas, but there are, with perhaps one or two exceptions, no gasoline plants at all.

Mr. Crawford—Replying to the gentleman from Waterloo on the sale of arcs. We sell those at $2 when they are installed and $2 a month. If you can get the customer to buy the appliance and pay for it, he is going to keep it, and the only man I have in mind now using gasoline in Clinton is one that I went after on this insurance proposition. I talked to him a few minutes, and made up my mind that it was not a very good proposition on which to go after him; that we had better talk the quality of our gas. It makes a man antagonistic to the company if you try to have a law passed prohibiting the use of anything else.

Mr. Haines—I think Mr. Crawford is right as to antagonizing the consumer. As a matter of fact, insurance companies permit the use of the Pitner light, which is a light with a hollow wire; but some of the other types in which a tin tube is used are prohibited. I think the only way to get at the consumer, if it is worth while at all, is to reach him through the insurance broker; but I doubt very much if that is a good commercial proposition. I think it is bad practice. As to using the harp light in place of the arc light, because the consumer wants to reduce his bills, if a consumer is satisfied to use gas you want to sell him just as little as he can get the full use of. The moment you give him more gas than he needs you have a kicker, and the only thing to do is to convince him that the harp light will not give him enough light for his business, and the more light he has the more business he will do. Of course, we want first a satisfied consumer, and if you can make him satisfied by reducing his gas bills, I think it is better policy to do that as much as possible. At the same time don't lose sight of the fact that if he has a permanent store in the town it is a logical and perfectly proper argument to use that he must have the best lighted store. Say that it will cost him more, that he ought to spend more because he will get more business from it, and I think you get the goodwill of many customers in that way who will appreciate it. An installation of the gasoline system in Des Moines was made by a personal friend of mine. I visited him when I learned he expected to put in. I told him he had a store on one of the best streets in Des Moines, that these lights were inferior in appearance and would injure his trade, because they looked cheap and poor. He said he was under obligation to the man who was installing the system—I think belonged to the same lodge—and he wanted him to try them. I told him to go ahead but not to take out our lights, and when he wanted this man to take down the gasoline lights he could turn on ours. He didn't have the gasoline lights 3 weeks. They didn't make as good a showing as our arcs. Another installation was in a small bread and cake store that flourished about a year, I think, but finally the man simply removed them and came around to us and bought an arc light. I think it is not always good policy to solicit the business as soon as the gasoline installation is made. I think if you will leave a man alone he will get dissatified sooner or later, and then is the time to go to him. If you present your argument as soon as he gets the installation set up, the man says, "Here, I am not going to be a fool and throw my money away," and he feels as if the gas company were trying to work him out of it; and we don't want to do that. We present a better proposition to him, and if he is not satisfied that it is such he will have to find out, and I think he finds out with a better feeling toward the gas company if you don't go after him too hard.

Mr. Martin—I would add my mite to the experience in the gasoline business. A few years ago they invaded our city and took 38 customers away from the gas company. As I was pretty new in the business at that time it scared me, and I took the matter up with the vice-president. About that time a gentleman from Philadelphia came along, and his suggestions were along the lines of those of Mr. Haines—that if we would let them alone they would die a natural death without any worry on our part or going near the customer, and such was the fact. With 38 plants at one time installed in Omaha, to-day there are just four, and the people using them have had trouble with both the gas and electric light companies on account of the bills. Two of them are saloon keepers, who are antagonistic to almost everything that is good. They are not satisfied with the light, but they won't take it out.

Mr. Roper—I would like to say, in regard to antagonizing gasoline competition, that no one ever tried that harder than they did in the early days of the gas stove business. A great many companies went so far as to publish a statement from the Fire Marshal of the number of gasoline explosion fires, and in almost every case where that was done it resulted in a boomerang. When they quit that and simply attended to their business, the gasoline stove went out of business. There aren't any more of them except in the country towns. We have not heard from Dubuque.

The President—I can only say about Dubuque that the gasoline question hasn't troubled us at all. Someone came along there who put in a few plants, but I mentioned to the contract manager of the insurance companies, then located at Dubuque, that the contrivance was unsafe, and after they heard the argument of a great many engineers there, the insurance companies thought we were justified in our opinion. They put in 5 of those particular plants there, and without exception every one of them had an explosion. They were taken out and we haven't had any others take their places. In Waterloo the most successful place I noticed was a jewelry store. Jewelers are fair mechanics, and if they are willing to work for 5 cents an hour they can possibly put the cost on a basis of making it compete with gas; but I suppose mechanics in our town want something for their time and labor. At any rate, they don't want the gasoline, and in our case gasoline is absolutely no account.

Mr. Averill—I don't think there is a gasoline plant in this town. We have had a few on the outskirts where our mains do not reach, but as soon as we have reached the territory they have all put in gas. We have never considered them any competitor in business. Perhaps where we fall down on the arcs is in not canvassing for them. We have only one or two outside arcs. I would like to ask Mr. Vincent how many outside arcs they have. I notice they run theirs out from the store fronts.

The Secretary—About 300. The great advantage of outside arc lighting is that you get business that you wouldn't otherwise get. The outside arc always replaces an electric lamp or is an additional installation; therefore, I think we can afford to spend a little more money on our outside than on our inside arc lighting.

Mr. McLean—At Dubuque we began first with one business block which we are lighting with arc lamps. We have one or two at every store in the block. We light those on a flat rate from dusk until 10 o'clock under daily contract. I may say further, in regard to your inquiry about gasoline machines at Dubuque, that the largest user there—the last that was discontinued—was an installation that paid us $300, and we have from the same Order—the Sisters of Charity—a proposal to pay us for extending our mains to another point where they are now using gasoline.

Mr. Martin—You say you have one arc light in front of every store; it is probably your Company that I heard about in regard to posts.

Mr. McLean—We have some outside arcs on cast iron posts with a swan neck, but those are not the lamps to which I am referring. The lamps we have put in, with the exception of three previously installed, are extended from the lintel over the door.

The President—Gentlemen, we would like to hear from any who can contribute to this discussion.

Mr. Pratt—I don't know that I can contribute anything, but one point that I think has not been touched upon was suggested by Mr. Averill. It seems a mistake for a company to loan lamps. A person who has no investment in an article has very little appreciation of it, and is always susceptible and desirous of making a change every time a new article comes out, whereas if he has something invested in the

original appliance, he is interested in that appliance continually. As Mr. Clabaugh frequently said, I think people are willing to pay something, if they are educated along that line, for almost anything they have, and the low prices at which arc lamps are sold and placed it seems to me would put them within the reach of almost any storekeeper. I am strongly opposed to the idea of loaning any sort of appliances.

Mr. Averill—I think it would be better to sell our lamps, but at first we got a higher rental, and our first lamps really paid for themselves. I believe the arc light is profitable for a gas company on almost any terms, even if you have to furnish the lamps free. We consider an arc light about an equal consumer of gas with a gas stove.

Mr. Pratt—Mr. Averill has 600 lamps in the town that belong to the Company. There is an investment of practically $3,600. I venture to say that if that $3,600 were put into the employment of an intelligent solicitor, he would sell double 600 lamps in this city at a price of $8 each.

Mr. Roper—The average gas arc is a better consumer than the average 18-inch stove, for the simple reason that it is burned a greater number of hours. A gas stove is installed to get breakfast on in 5 minutes, where it used to take an hour; and other things in proportion. But that is not what I would like to get at. For the past 10 years 99 per cent. of the gas companies have been educating the people to the fact that they must accept something from the gas company for nothing, and they started out with the idea of giving them a stove for less than cost. I think I am safe in saying that, prior to 3 years ago, I had only one customer selling stoves at a profit. All the rest were selling at cost or less, and those selling for cost were making service free, so that the stove installed was a loss. The companies have lost anywhere from $1,000 to $30,000 a year, but the last 3 years they have gone the other way, and the man that is not trying to educate the public up to the idea that if you get anything you will have to pay for it, ought to get into the band wagon.

Mr. Martin—The remark about the average American citizen getting something for nothing, and not appreciating it, calls to my mind a remark I once heard Robert G. Ingersoll make in a semi-temperance lecture. He went on to say that the American people, unless you made it hard for them to get a thing, did not appreciate it in any case, and that if the Mississippi river was a flowing stream of whiskey, with tin cups every 2 feet, there wouldn't be a-hundredth part of the whiskey drank in the United States that there was at that time.

Mr. Stewart—As to the question of whether it is good policy to sell the arc or not, the thought just come to me is whether a little dealer who could put up with one or two lights in store would pay for an arc? If we lend him the light at 50 cents a month we can put in one, possibly two lights in his store. Has the gas company made more money than it would have made if it had sold those lights? It appears to me it has. I recall the time at St. Louis when we knew every consumer of electricity, had our best solicitors call on them and work on them for 6 months to try to switch them over to gas, and had very poor success. We started out by putting in the light free to those consumers. It was supposed to be on the quiet; the public didn't know anything about it. Out of something like 1,000 consumers I believe we switched over close to 700 to gas, but we couldn't have done it unless we put in that light free of charge. That was 2 years ago, and they have a greater percentage to-day.

Mr. Hunting—I am interested in this question because there are two sides to it. I have had success in both ways, and believe it all lies in the salesman or whoever has charge of obtaining the business. I found it just as hard to give an arc away, hang it for nothing and maintain it for 25 cents a month as to sell it for all the way from $10 to $18. My first experience was in selling them at $18 and maintaining them at $1, and I had no more trouble to maintain that price and keep them there than at the other extreme of giving the arc to them, installing it and maintaining it at 25 cents. So I believe all there is to it is the salesmanship. Whatever you go for, get. Some gentlemen here no doubt remember when the stove business was in its beginning (my first knowledge of it was the Standard Company, of New York city), when they paid us $5 apiece to put out the stoves. We had a great deal harder work to get them out then than we do now to sell a $20 or $30 stove.

The President—We will now call on Mr. Grey to close the discussion.

Mr. Grey—We have had a little experience in renting arcs in Des Moines at $3 per year. We started in a year ago last March, so that we have had three months recently to call on them. About 90 per cent. of these we have been able to sell for the additional $5, allowing $3 for the first year's rental. I think it will go to show that the renting plan pays. Of course in addition to this $3 for rental we have charged for maintenance. We have a small plant in a town of about 2,500 inhabitants near Des Moines supplied by a high pressure main, and there are about 30 business houses all supplied with gasoline plants before we turned the gas on in this particular place. Without one exception we have displaced the gasoline. They are using mostly arcs and a very few 1-mantle arcs. As Mr. Vincent says, we have about 300 outside arcs in our city. When we have a heavy rain some of them will go out, and where we have a consumer that is somewhat particular we send a man around, and if the lamps happen to be out we relight them. One gentleman said he believed in employing boys in the maintenance department. I have been very unsuccessful in that respect. The boys can be found most any time playing pool or going to ball games; while if you employ a man he is more reliable in every respect. When I speak of boys, I mean boys of 16 to 18. I think when a boy has reached his majority we have to call him a man. Our men are from 21 up. We pay about $1.75, as I said in my paper, and get very good help. As to taking out arcs in summer time, one gentleman said he didn't think over 5 per cent. would come out. Well, I think if he allowed the 5 per cent. to come out, the stores in the neighborhood would get onto the fact, begin to think about the matter and do the same thing. So we would rather leave the arcs in for the summer months and cut out the maintenance charges.

On motion of Mr. Maple a vote of thanks was awarded to Mr. Grey for his paper.

[To be Continued.]

Relative Cost of Steam and Producer Gas Compared.

By Mr. J. R. Armer, Toronto, Ont.

The methods of manufacturing producer gas may be classified under two headings, according to the way in which the draft is created—namely, induced or forced.

Almost any carbonaceous fuel may be used in the manufacture of producer gas, including charcoal, coke, hard coal, lignite, peat, wood, sawdust and even city refuse. If coal is used it should be of good quality. It should have a low percentage of ash and should not clinker. In case the gas is to be used in gas engines or in the manufacture of iron it should contain a low percentage of sulphur. The coal should be as nearly uniform in size as possible, and not too large. The fuels used in suction producer gas plants, which are the most common in small units, are usually coke or anthracite coal. These fuels do not clinker, and they produce a gas containing a low percentage of tar. Lignite and peat have been used in Europe in pressure producers, and the gas has been used for gas engines in many instances.

Some of the devices used for cleaning are as follows: Liquid scrubbers, rotary scrubbers, deflectors and absorbers. The abstraction of tar is one of the greatest difficulties met with in cleaning producer gas, and as its elimination is absolutely necessary for the best results in gas engine practice, the means adopted for its removal are very important considerations.

Where there is an excessive amount of tar some builders use rotary scrubbers, or tar extractors, in addition to the wet scrubbers. They claim very satisfactory results. Other makers, instead, advocate having the fires so arranged that the tendency is for the tar to be converted into a permanent gas in the producer. To accomplish this the products of distillation are passed through a hot bed of fuel.

One of the important points about a producer gas plant is the short time required in starting, and the little attention required when it is standing idle; even after several hours' idleness the plant may be started and be working at its full capacity in a few minutes.

The labor required to operate with a pressure producer plant is about the same as that required for a steam plant of similar size, while with a suction producer plant the labor required is much less.

The amount of water used in a producer plant is not more than half that required in a steam plant of similar size. If the cooling water used in the scrubbers be used over and over again this will be greatly reduced.

No more skill is required to handle a producer gas power plant than is needed for a steam plant of similar size; but it may require some time for men trained to handle steam plants to become accustomed to gas engines and gas producers.

For best results plants should be kept clean, pipes should be kept gas-tight and arranged so that they may be cleansed of dust and tar; scrubbers should be inspected periodically, to see if the coke or other material is clean enough to assure efficient working. They should be cleansed once in six or eight months, according to conditions.

The fire should be drawn from the producer about once a week, and the clinkers removed; if the fires are rekindled immediately so that the firebrick lining is not chilled, the life of the lining will be prolonged considerably.

The regulation of the steam supply to the producer is of considerable importance. In pressure producers the regulation is not very difficult, but in suction producers, where the air supply in the producer depends upon the load on the engine, it requires special attention. The amount of steam going into the suction producer must always be proportional to the amount of gas used by the engine, so that the fires will neither become too hot nor be dampened. Different firms have different methods of regulating this.

In the case of the gas producer, the gas is conveyed to the engine cylinder, where almost perfect combustion is obtained. The losses in this case are occasioned mainly by the heat radiated from the pro-

ducer and connecting pipes, in the heat lost in cooling the gas, in cooling the engine cylinder, and in that lost in the exhaust from the engine. The amount of energy lost in this way compared to the amount originally in the coal is very large; the proportional loss, however, is much smaller than in a steam plant.

In a steam plant all the combustion takes place in the fire box, under poorly regulated conditions, an excessive flow of air always being required which carries a large proportion of the heat up the stack, together with unburnt gases, and particles of carbon in the form of smoke. The remaining heat is absorbed by the boiler in generating steam, or is radiated from the fire box; further losses occur through the radiation from the steam pipes and engines, and finally there is the large loss from the exhaust on the engine.

The following heat losses in a modern steam plant, when compared with the losses in the gas plant, will give an idea of where the greater efficiency of a gas power plant, over a steam plant, comes in: Out of 13,500 B.T.U., the value per pound of coal used in the fire box, 135 B.T.U. were lost in ashes, 675 in radiation from the boiler, 2,970 in chimney loss, 190 in auxilliary exhaust, 520 in radiation from steam pipes and engine, 7,737 in the exhaust from the condenser, 1,273 were converted into power. Considering the mechanical efficiency of the engine as 93 per cent., this would give 1,176 B.T.U. as delivered from the engine in brake horse power. By comparing 1,176 B.T.U. with the original 13,500 B.T.U., the efficiency of the whole plant is 8.7 per cent.

As a comparison with this, the following figures have been taken from a report on tests made with the Crossley suction gas plants and gas engines by consulting engineers and others, and read before the Manchester Association of Engineers in connection with a paper on this subject.

In the tests reported, the thermal efficiency of the plants ran as high as 24.95 per cent. One of these tests was made with a plant at Milford-on-Sea Electric Works, which at the time of making the test had been in operation for some months. The efficiency of this plant was low in comparison with some of the results obtained, as will be seen, so that the comparison is conservative. The fuel used was anthracite coal having a heating value of 14,895 B.T.U. per pound. The indicated horse power of the engine was 46.25 I.H.P. The test lasted 3 hours 49 minutes. The total amount of coal used was 133.5 pounds; the coal used per I.H.P. hour was .785. Assuming that the mechanical efficiency of the engine was 85 per cent., the amount of coal per B.H.P. would be .89 pound. The value in B.T.U. of .89 pound of coal would be 13,256 B.T.U., which, when compared with 2,545, the B.T.U. value equivalent to 1-horse power, gives the efficiency of the whole plant, including the mechanical efficiency of the engine as 19.35 per cent. If the losses in this case be divided up according to the usual proportion of loss in the different parts of the suction producer power plant, they will be as follows: Out of 13,256, the B.T.U. value of the fuel used, 2,651 are lost in ashes, radiation, cooling of gas, etc., 4,445 in exhaust and 3,166 in cooling the cylinder; the remaining 2,994 are converted into power; the efficiency of the engine being 85 per cent., 2,545 of these are converted into B.H.P.

In comparing these two plants, the efficiency of the steam plant being 8.7 per cent., and that of the gas plant being 19.35 per cent., we find a saving of 55 per cent. in favor of the suction producer power plant. In neither of these cases has allowance been made for standby losses, which favor the steam plant.

Regarding the fuel required per horse power, manufacturers make numerous claims, many of which have been substantiated. The claims average about 1 pound of anthracite per horse power per hour, and vary from 0.6 to 1¼ pounds per B.H.P. per hour. The 0.6 figure is pretty low, but numerous tests have shown a consumption as low as 0.8 pound anthracite per B.H.P. per hour.

Considering the high thermal efficiency and the many other points of advantage about a producer gas power plant, its outlook for the future is very bright. It has passed the experimental stage and has become a formidable competitor of all classes of power. Its field of usefulness will doubtless be widened greatly, and already it is being considered as a means of propelling vessels, driving traction engines and for developing power under many other conditions.

In the discussion of this paper several points of interest were brought out. Mr. Samuel Groves said that the pioneers in this work were the French Canadians. To his knowledge over 10 suction gas plants had been installed in Quebec. In England they are ahead of both Canada and the United States in the utilization of the gas engine. The United States, however, have beaten the world in the use of the gas producer. The best practical results in Canada have been achieved at Wellington, Prince Edward county, Ont. There with a 65-horse power suction gas plant, electrical energy is being supplied at $20 per horse power year, 10-hour day; 18 arc lamps for street lighting at $530 per annum. The stores and residences pay one-half cent per night for continuous incandescent light. Mr. Groves spoke of the electric furnaces as having a bright future, and brought out the fact that the waste gases produced in the electric furnace are comparatively pure, and are, therefore, very suitable for use in the gas engine. He predicted that the suction gas producer system would play an important part in opening out and developing industries in the great Northwest, where lignites abound.

Mr. R. J. Goudy pointed out that economy of the gas engine operated by producer gas lies in the almost direct conversion of the energy in the coal into work. He said that the United States navy were adapting the gas producer and gas engine in naval work.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE new net rate ($1.10 per 1,000 cubic feet) became effective at Gloucester, Mass., the 1st inst. Good for Mr. Coffin and his men.

THE Board of Gas and Electric Light Commissioners has authorized the issue of 650 shares additional capital stock by the Webster (Mass.) Electric Company, to enable the latter to purchase the properties of the Southbridge Gas and Electric Company.

AT the hearing before the Massachusetts Board of Gas and Electric Light Commissioners, set for the purpose of listening to arguments for and against a prayer of the Springfield Company to issue additional capital stock in the sum of $350,000, no opposition was voiced. In the hearing it was developed that the Company's output for the first half year of 1907 was 20 per cent. over that for the corresponding half of 1906.

AT the annual meeting of the shareholders in the Milwaukee Gas Light Company, the following officers were elected: Directors, S. J. Glass, J. P. Murphey, N. P. Hulst, August Luedke, O. C. Fuller, W. Sieg, E. J. Lindsay and A. K. Hamilton - the two last named succeed Messrs. Ira B. Smith and S. M. Green; President, E. McMillin; Secretary and Treasurer, Ewald Hasse; Chairman Board of Directors, J. P. Murphey.

MR. WILLIAM MORAN has resigned the place of Manager to the Hillsdale City (Mich.) Gas Company in order to go on higher up in the service of the Messrs. Lloyd.

A CORRESPONDENT in St. Louis, writing under date of the 3d inst., had this to say: "Dear JOURNAL: It will no doubt be of interest to the gas profession to learn of the merging of the interests of the Laclede Firebrick Manufacturing Company and the Christy Fireclay Company into one corporation, to be known as the Laclede-Christy Clay Products Company. Mr. James Green, who as every gas man knows has been identified with this industry and the gas industry generally for over a half century, will be Chairman of the Board of Directors of the new Company, and Mr. Calvin M. Christy, President of the Christy Fireclay Company, which concern of recent years has come to the fore as an important producer of high grade bench material and water gas linings, is to be Chairman of its Executive Committee. Mr. William C. Morris, former Vice-President of the Christy Fireclay Company, will become President of the new corporation, and John L. Green, former Vice-President of the Laclede Firebrick Manufacturing Company, will act as Vice-President. The Board of Directors will comprise the above-named gentlemen, and the following: R. D. Hatton, who will be the Company's Secretary and Treasurer, and Mr. Montague Lyon, who will be the Company's Council. Mr. Charles J. Parrott will assume the duties of Assistant Treasurer and those of Assistant Treasurer will be borne by Mr. Vincent L. Lamy. Mr. Robert H. Miller is to have general charge of the Sales' Department, assisted by Messrs. Paul C. Güignon and Charles H. Leffingwell. Mr. Roger W. Polk will continue with the new corporation in his former capacity with the Laclede Firebrick Manufacturing Company, as Gas Engineer. With the merging of the interests of these two companies, both of which have been engaged for many years in the manufacture of fireclay products, the new concern will be a large one and a strong one in this line of business, and the former prosperity of each as an individual concern will no doubt be greatly augmented by the coalition. With the enormous capacity of the Christy and Laclede plants as already existing, taken in connection with the extensions and betterments thereto that are now being planned, the Company will undoubtedly be able to execute contracts of any magnitude in fireclay products in general.—R."

WE are indebted to Mr. H. T. Carpenter, of the Bristol Company, of Waterbury-New York, for a copy of its latest Bulletin, which has to do with "Plant Economy." The matter between its covers was compiled by Mr. H. P. Dennis, M.E., the well-known authority on power plant equipment, and it is in his best style. Write to Mr. Carpenter for a copy of it. His address is "The Bristol Company, Waterbury, Conn."

MAYOR RICHARD KIRKMAN, of Reno, Nev., is insisting that the City Council shall pass an ordinance declaring that the Reno Gas Company must not charge a rate in excess of $1.50 per 1,000 cubic feet. The ruling rate is $2.50 per 1,000, which, under the conditions governing the gas supply of Reno, would correspond to a rate of $1.25 in Salt Lake City.

WE are indebted to Mr. George C. Turner, Secretary of the Coldwater (Mich.) Gas Light and Fuel Company, for the following, under date of the 6th inst.: "Dear JOURNAL—Our attention has been called to a paragraph in your issue of June 10th, in which it is claimed that Noblesville, Ind., has the distinction of having the greatest number of gas consumers of any city in the United States of like population. On refering to 'Brown's Directory' we find that the gas sold in Noblesville is natural gas, that there are 45 miles of mains, and that the population of the district served is 7,500. Now, we always supposed that we held the honor claimed above, at least as to artificial gas, which is the commodity with which we serve our consumers, and as we note that no other Company has challenged the claim put forward by Noblesville, we will state that the population of the city of Coldwater is 6,200, and that, on July 1st, the Coldwater Gas Light and Fuel Company had 1,432 consumers on its ledgers, with 1,300 gas stoves and 330 Humphrey gas arcs in use.

THROUGH the agency of The Gas and Electric Development Company, a sale of the Magnolia Light, Heat and Power Company, of Warrensburg, Mo., to Philadelphia parties, has been consummated. The plant will be rebuilt to a considerable extent. A new company has been incorporated with a capital of $50,000, under the title of the Warrensburg Light and Power Company."

A CORRESPONDENT in La Porte, Ind., sends the following: "In the County Fair this year a number of worth while prizes are to be given in the women's department; and now Manager Hulswit, of the La Porte Gas Light Company, announces that in one section he will double the value of the prizes offered by the Fair Association. On the Premium List, Class XXVII. of the women's department, is devoted to 'Table Comforts.' Many good prizes are put up for exhibitors here, and seven of them are for minors under 16 years of age. They are practically all for cooking and cooked articles, all sorts of loaves, biscuits and cake. In 25 of the articles named the Company will double the prizes offered by the Fair Association, which offers for the first prizes from $2 to ½ dollar and for second prizes from ½ dollar to ¼ dollar. These sums will be raised by the Company to from $4 to ½ dollar. The only condition is that the Company's premium must be cooked on gas stoves, which is a condition easily met from the number of such cookers in use in the homes throughout the city."

THE proprietors of the York (Me.) Light and Heat Company have reduced the selling rate to $1.50 per 1,000 cubic feet—virtually a concession of 50 cents per 1,000.

A GAS plant for Tropico, Cal., is to be constructed by the Tropico Improvement Association. The main factor in the preliminaries is Mr. J. A. Garmon, President of the Association.

THE Gas Machinery Company, of Cleveland, O., will construct the new condensing and scrubbing machinery that has been arranged for by the Chattanooga (Tenn.) Gas Company. The apparatus will be housed in new buildings, and the total expense of the betterment will approximate to $100,000.

AT the annual meeting of the Louisville Gas Company the Directors were authorized to sell as many bonds on the Louisville Lighting Company as will be necessary to pay for the construction of the office building to be erected on the site purchased some months ago on Chestnut street, between Third and Fourth avenues. The Directors re-elected were Messrs. Udolpho Snead, F. M. Sackett, H. V. Loving, John Stites and D. X. Murphy.

THE proposed legislative enactment permitting the Taunton (Mass.) Gas and Electric Company to do business in the adjoining district of Dighton, having received the sanction of the Board of Gas and Electric Light Commissioners, will be accepted and worked under at once.

MR. A. W. ZAHM, formerly in charge of the business of the Mason City (Ia.) Peoples Gas and Electric Company, has been appointed Manager of the Fort Dodge (Ia.) Light and Power Company.

A CORRESPONDENT in San Antonio, Tex., forwards the following, which is supplementary to the item printed by us recently: "Mr. E. C. White, who has been Superintendent of the gas department of the San Antonio Gas and Electric Company for several years, and has built up the service of that Company to its present high standard, has resigned his position to accept the Eastern Sales' Agency of the Western Gas Construction Company, with headquarters in New York. He was one of the most competent officials of the Gas Company, and his resignation is regretted by the entire management. Mr. L. B. Moorehouse, formerly Assistant Superintendent of the Gas Company, but now in Cincinnati, has been appointed to succeed Mr. White and will reach the city in a few days to take up his new position."

MR. SMITH W. CUNNINGHAM has been appointed Superintendent of the Waynesboro (Pa.) Gas Company, vice Edward Warren, summarily discharged.

AT a recent meeting of the Richmond (Va.) Common Council the resolution awarding the contract for the rehabilitating of the City Gas Works to the Stacey Manufacturing Company, at its bid of $310,000, was confirmed. The street main contract goes to Messrs. R. D. Wood & Co., at their bid of $31,230.

THE old gas plant at Gloucester City, N. J., has been dismantled and the site is in the market for sale.

MR. J. A. STANTON, of Cincinnati, O., has been elected Secretary and Treasurer of the Mt. Carmel (Ills.) Gas and Electric Company.

JUDGE PORTER has decreed that $500 is ample compensation for the services of Mr. M. E. McCaskey while acting as Receiver for the proprietors of the Lawrence Gas Company, of New Castle, Pa.

THE proprietors of the Millville (N. J.) Gas Light Company announce that after January 1, 1908, the selling rate shall not exceed $1 per 1,000 cubic feet. The great use of gas for cooking enables the Company to make the cut.

"L. P. R.," writing from St. Louis under date of the 2d inst., inclosed the following: "Many residents on Locust street and Washington avenue were victimized last week by a swindler who represented himself as a collector for the Laclede Gas Light Company. His plan was to follow employees of the Company who were distributing gas bills for June. When he saw one of these leave a residence he would ring the doorbell, announce himself as an Inspector for the Company and ask if a correct bill for June service had been received. The bill which had just been left usually was produced. The 'Inspector' then would announce that the Company had abandoned its branch offices and that payments in the future must be made at the main office. He would volunteer to receipt the bill if the customer wished to send the money by him. Many took advantage of the supposed opportunity to save a trip down town. In each case he receipted for the Company on the back of the bill. The swindler is described as being 20 years old, 5 feet 6 inches in height, of stocky build, weight about 135 pounds, dark hair, and almond eyes, which give him the appearance of a Japanese. Officers of the Company say they believe he is a former employee and have asked the police to look out for him."

THIS is the language of the decision of the late New York State Commission of Gas and Electricity in the matter of the testimony taken at the hearings to consider why the rate in Buffalo should be reduced:

"*Ordered*, That the maximum price for gas which shall be charged to consumers by the Buffalo Gas Company in the city of Buffalo, be and is hereby fixed at 95 cents per 1,000 cubic feet, and it is further

Ordered, That the pressure of said gas in any service mains in the said city shall be such as to balance a column of water not less than 1 inch in height."

MR. W. A. ALDRICH and associates have been granted a franchise whereunder they may manufacture and distribute gas in Centralia, Wash. The grant is to be operative for 50 years, and it is specified that the selling rate shall not exceed $2 per 1,000.

AT the annual meeting of the Burlington (Vt.) Gas Light Company the following officers were elected: Directors, F. H. Parker, M. S. Stroud, W. P. Murphy, S. B. Curtis and Walter Godley; General Manager, F. H. Parker.

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PROPRIETORS.

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JULY 15, 1907.

The Market for Gas Securities.

The peculiar conditions of the money market affected the general stock market in a queer degree last week. Lack of confidence was everywhere manifested, but the bears were confronted with the odd fact that money seemed plentiful and that every temporary squeeze in loaning figures was quickly broken. However, for the week, those who deal on the low side had the best of the argument. Consolidated shows a net loss of 2 points in the trading so far as the bid is concerned, but this artificial retarding cannot last. Everything is on too favorable a basis for a continuance of depression. Consolidated opened to-day at 116 to 118. Brooklyn Union is lifeless, at 105 to 112.

Peoples, of Chicago, is down 2 points for the week and Massachusetts gas more than holds its own, despite the fact that there was no change in the arrangement for the dividends in the coming year.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JULY 15.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies	*Capital*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	116	117
Central Union Gas Co.—				
1st 5's, due 1927, J & J	3,000,000	1,000	101	104
Equitable Gas Light Co.—				
Con 5's, due 1932, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	190	225
New Amsterdam Gas Co.—				
1st Con. 5 s, due 1948, J. & J.	11,000 000	1,000	98	100
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p.ct.	1,000,000	..	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	101	103
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	108	111
Con. 5's, due 1945, J. & J.	1,500,000	..	104	110
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
1st Mtg. 5's, due 1930, M. & N	1,500,000	1,000	104	108
The Brooklyn Union	15,000,000	1,000	105	112
1st Con. 5's, due 1948, M. & N	15,000,000		107	..
Yonkers	999,650	500	130	..
Out-of-Town Companies.				
Bay State	50,000,000	50	¼	⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	500,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	9	10
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106½
Cincinnati Gas and Electric Co.	29,500,000	100	97½	98
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	87	88
Preferred	3,026,500	100	107½	108
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	..	90
Mortgage, 6's	3,500,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
Bonds, 5's	10,500,000	..	107½	108½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,550,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	200,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	86
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	05
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	76	83
Massachusetts Gas Companies of Boston	25,000,000	100	59	59¼
Preferred	25,000,000	100	83	83¼
Montreal, Canada	2,000,000	100	215	215½
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	5,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	90¾	91¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
" 2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105¼
San Francisco, Cal.	15,800,000	100	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
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General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,500,000	20	340	345
First mortgage 6's	600,000	..	..	..
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Wilmington, Del.	600,000	50	230	..

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Where
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p_1 = absolute initial pressure in pounds per square inch,
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(1.) Set the specific gravity of the fluid opposite the length of pipe;

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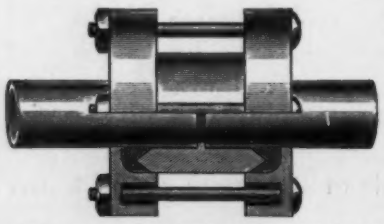
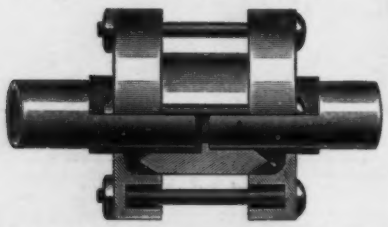
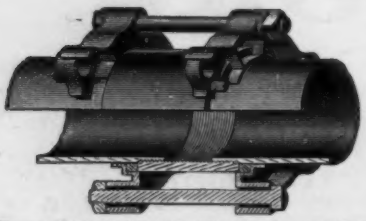
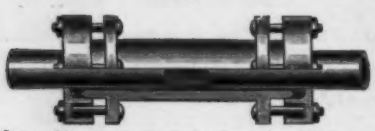

Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.


Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe,


Clamp, Style 4, for Repairing Leaks on Screw Collar.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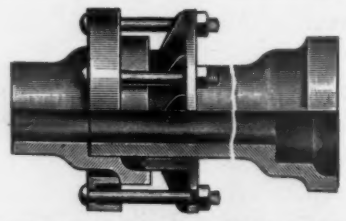
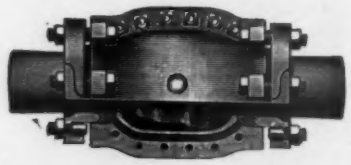
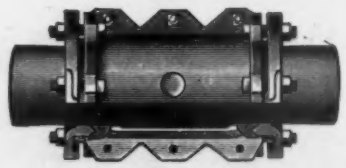
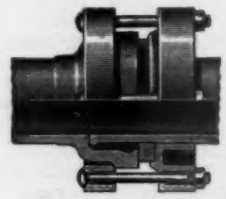

Coupling, Style 9, for Special Style Cast Iron Pipe.


Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.


Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.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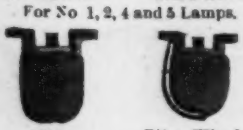
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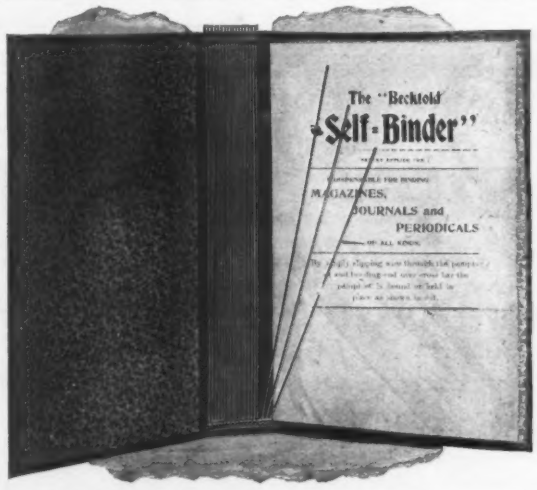

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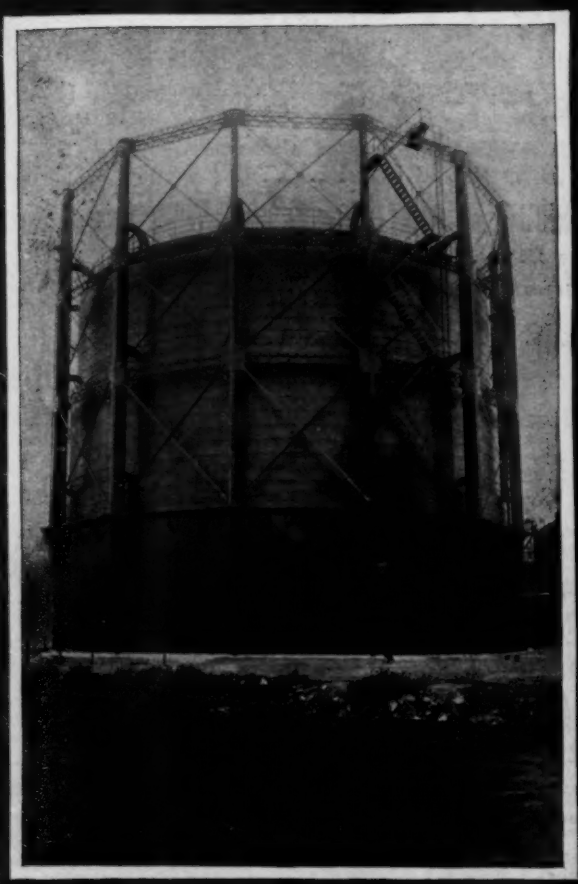

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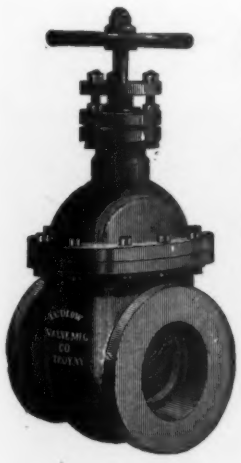

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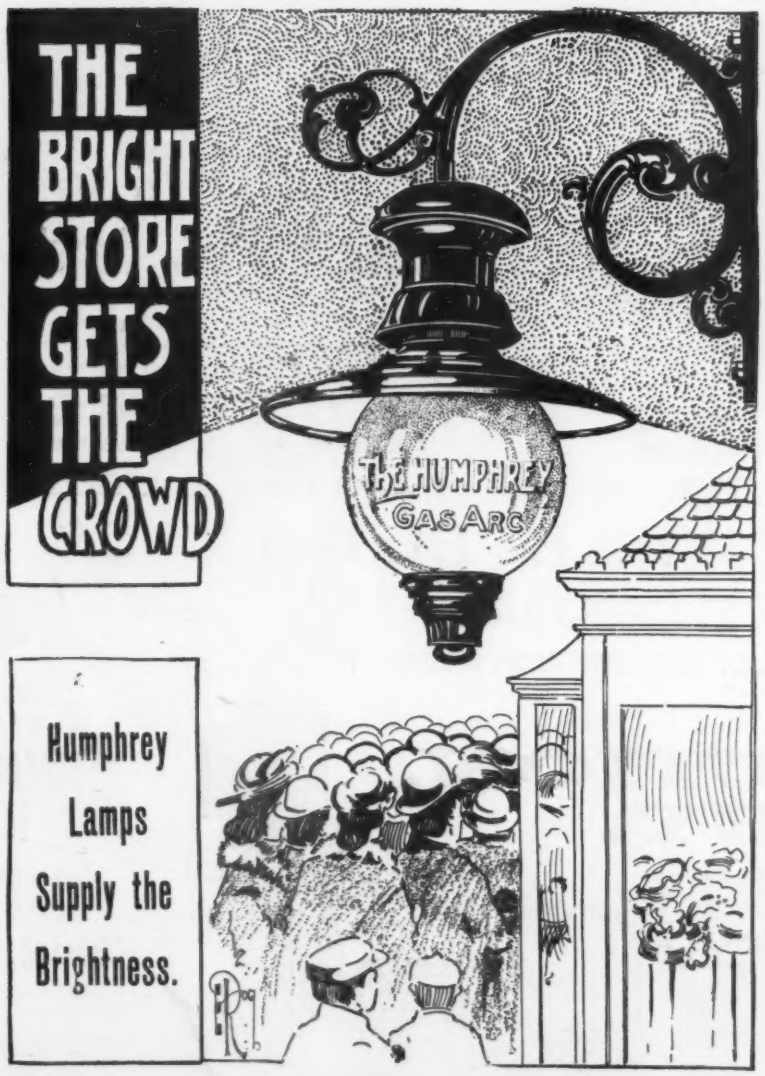

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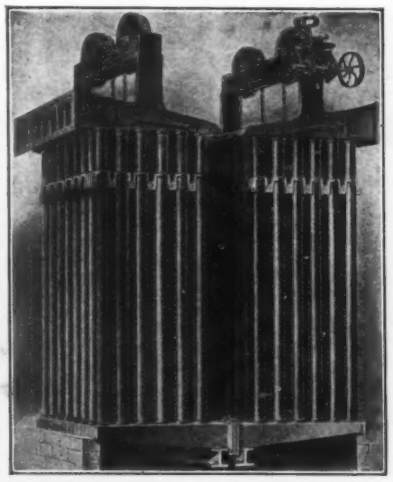

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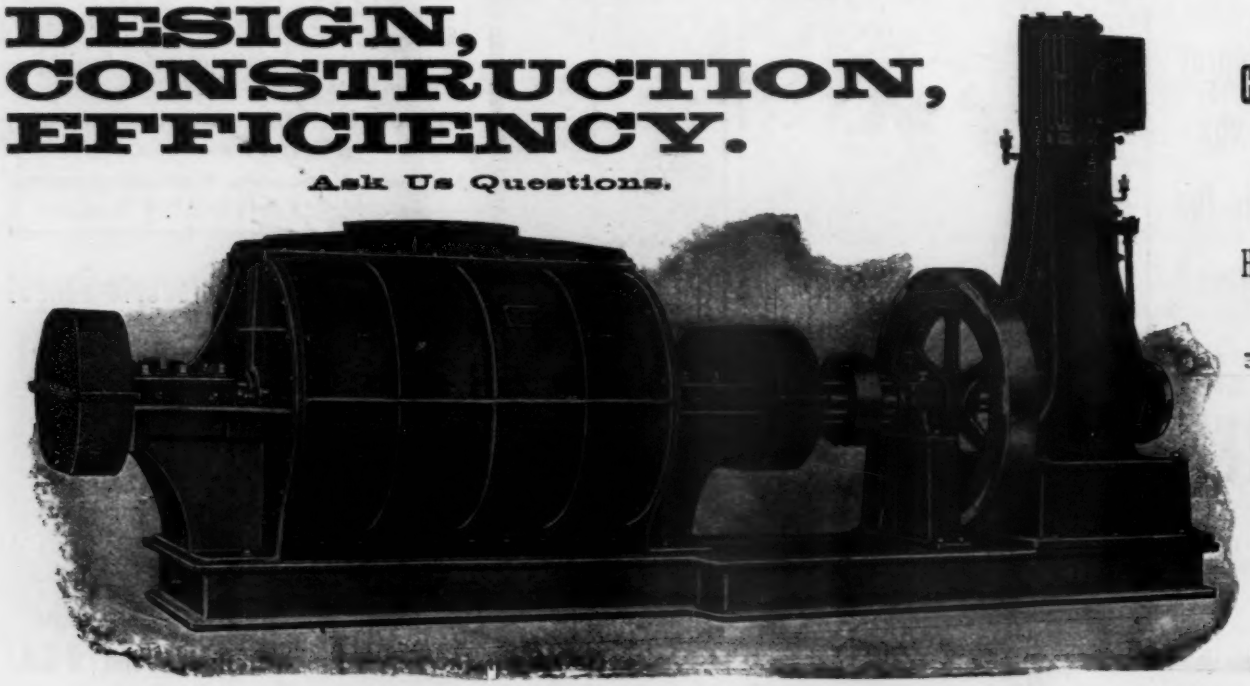

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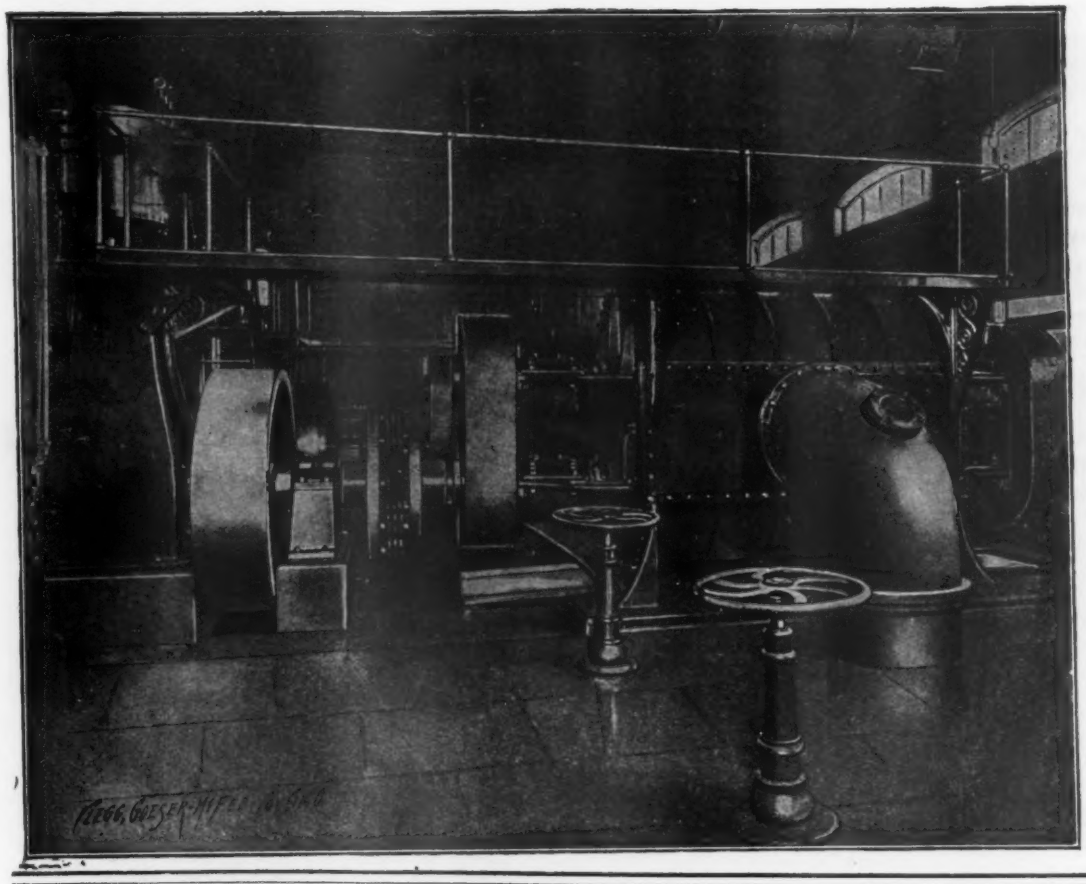

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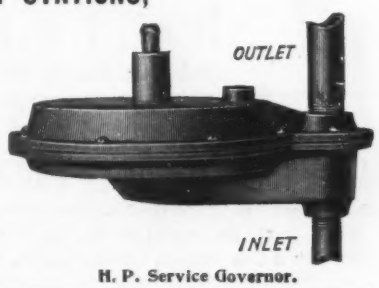

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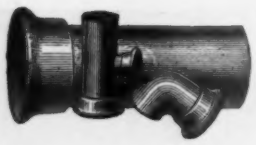

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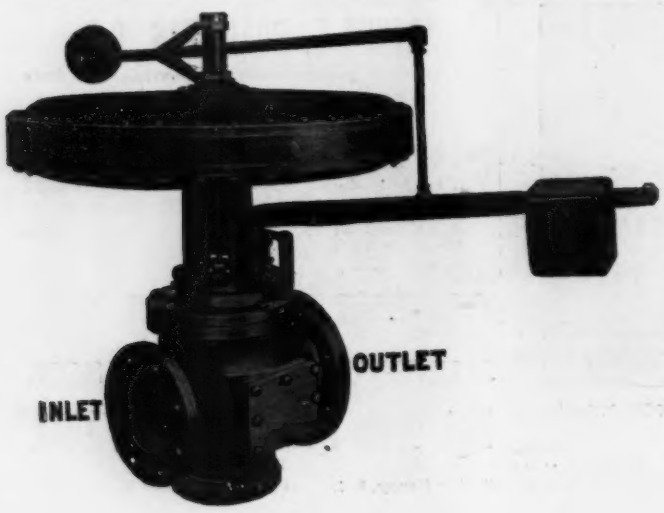

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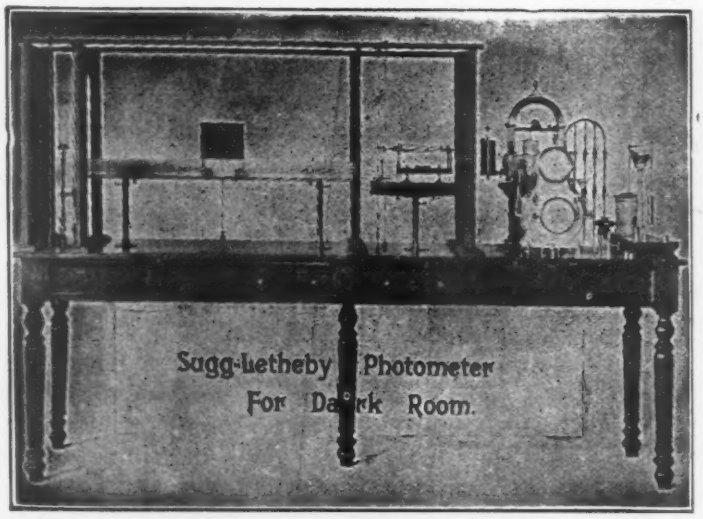
AUGUST, 1907.

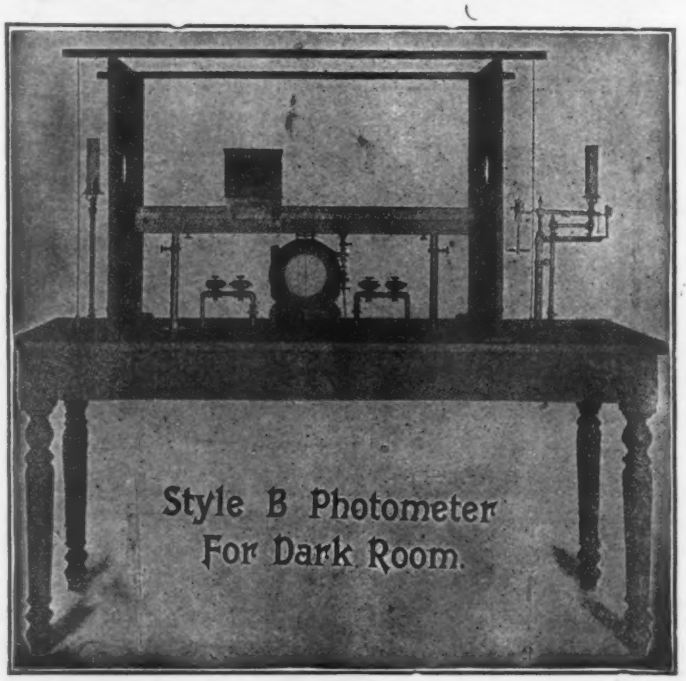
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Thu.	1	7.50 PM	12.50 AM
Fri.	2	7.50	1.30
Sat.	3	7.50	2.00
Sun.	4	7.40	2.40
Mon.	5	7.40	4.00
Tue.	6	7.40	4.00
Wed.	7	7.40	4.00
Thu.	8	7.40 NM	4.00
Fri.	9	7.40	4.00
Sat.	10	7.40	4.00
Sun.	11	7.30	4.10
Mon.	12	7.30	4.10
Tue.	13	8.40	4.10
Wed.	14	9.00	4.10
Thu.	15	9.40	4.10
Fri.	16	10.10 FQ	4.10
Sat.	17	10.50	4.10
Sun.	18	11.40	4.20
Mon.	19	12.40 AM	4.20
Tue.	20	1.40	4.20
Wed.	21	2.50	4.20
Thu.	22	No L.	No L.
Fri.	23	No L FM	No L.
Sat.	24	No L.	No L.
Sun.	25	7.10 PM	9.20 PM
Mon.	26	7.10	9.50
Tue.	27	7.10	10.20
Wed.	28	7.10	10.50
Thu.	29	7.10	11.30
Fri.	30	7.10 LQ	12.00
Sat.	31	7.10	12.40 AM

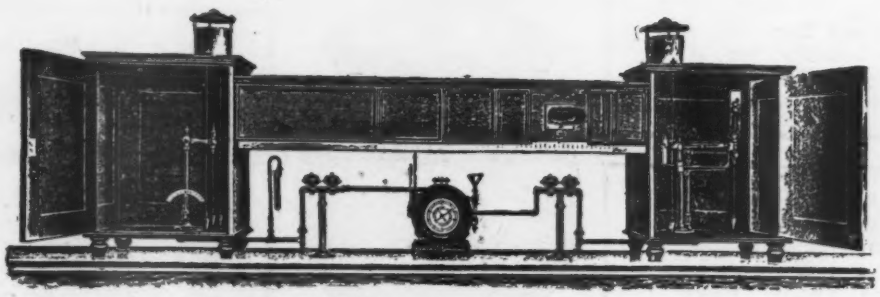
TOTAL HOURS DURING 1907.

By Table No. 1.

	Hrs.Min.
January	211.10
February	193.40
March	182.10
April	167.00
May	157.00
June	145.30
July	151.50
August	162.30
September	175.30
October	202.40
November	209.30
December	231.50
Total, yr.	2190.20







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

AUGUST, 1907.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. All Night Lighting. Light.	Extinguish.
		P. M.	A.M.
Thu.	1	7.10	3.30
Fri.	2	7.10	3.30
Sat.	3	7.10	3.30
Sun.	4	7.10	3.30
Mon.	5	7.10	3.30
Tue.	6	7.10	3.45
Wed.	7	7.10	3.45
Thu.	8	7.10	3.45
Fri.	9	7.10	3.45
Sat.	10	7.10	3.45
Sun.	11	7.10	3.45
Mon.	12	7.10	3.45
Tue.	13	6.55	4.00
Wed.	14	6.55	4.00
Thu.	15	6.55	4.00
Fri.	16	6.55	4.00
Sat.	17	6.55	4.00
Sun.	18	6.55	4.00
Mon.	19	6.55	4.00
Tue.	20	6.45	4.10
Wed.	21	6.45	4.10
Thu.	22	6.45	4.10
Fri.	23	6.45	4.10
Sat.	24	6.45	4.10
Sun.	25	6.45	4.10
Mon.	26	6.45	4.10
Tue.	27	6.30	4.20
Wed.	28	6.30	4.20
Thu.	29	6.30	4.20
Fri.	30	6.30	4.20
Sat.	31	6.30	4.20

TOTAL HOURS DURING 1907.

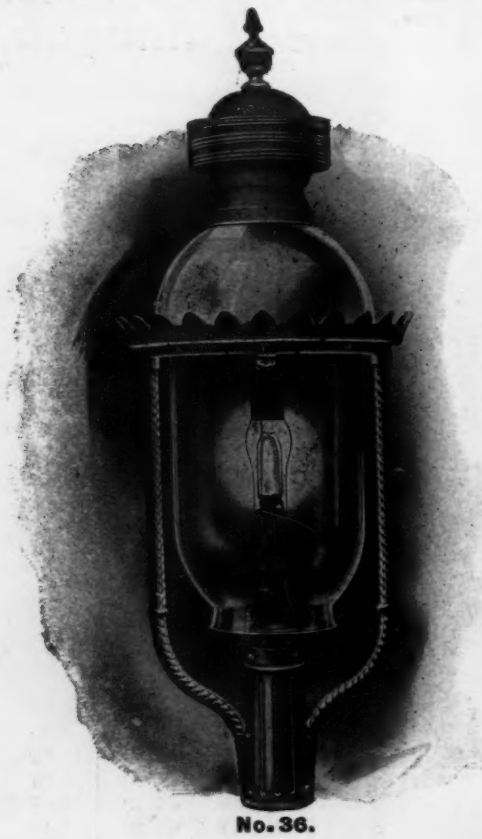
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building.
PHILADELPHIA, Broad and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY

....OF AMERICA....



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By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

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IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

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Will Fit Any Fixture.
Will Not Flash Back.
Will Not Blacken Mantles.
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Best Welsbach Quality.
Extra Strong and Durable.
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Rich Mellow Light.

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Protection from the Falling of Heated Particles.
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New Britain, Conn. (2d contract).
Malden, Mass. (3d contract).
Kirksville, Mo.
St. Johnsbury, Vt.
Memphis, Tenn. (2d contract).
Council Bluffs, Ia. (2d contract).
Seattle, Wash. (2d contract).
Philadelphia, Pa.
Waterbury, Conn.
Manchester, N. H.
Allentown, Pa.
Omaha, Neb.
Muskegon, Mich.
Nazareth, Pa. (2d contract).
Lewistown, Pa.
Greenville, Tex.
New York, Cent. Un. (3d contract).
Jefferson City, Mo.
Peekskill, N. Y. (2d contract).
Waterville, Me.
Washington, D. C. (4th contract).
Lawrence, Mass. (3d contract).
Hampton, Va.
Aurora, Ills. (2d contract).
Milwaukee, Wis.
Syracuse, N. Y. (2d contract).
Davenport, Ia.
S. Brooklyn, N. Y. (3d contract).
Delray, Mich.
Albert Lea, Minn. (2d contract).
Leominster, Mass. (2d contract).
Clinton, Mass.

TOTAL SETS INSTALLED IN 1906, ... 41
TOTAL SETS TO DATE, ... 634
TOTAL DAILY CAPACITY, ... 502,555,000 cu. ft.

Tar Extractors for Carburetted Water Gas.
Photometrical Apparatus.
Gas Analysis Apparatus.
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Straight Standpipe System for Coal Gas Retorts.
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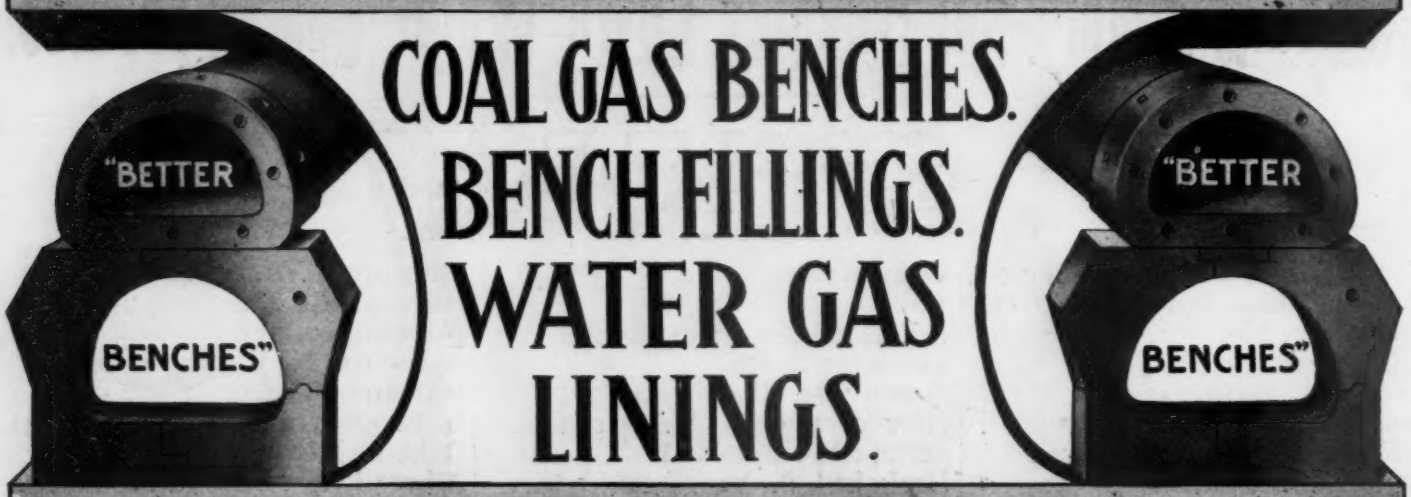

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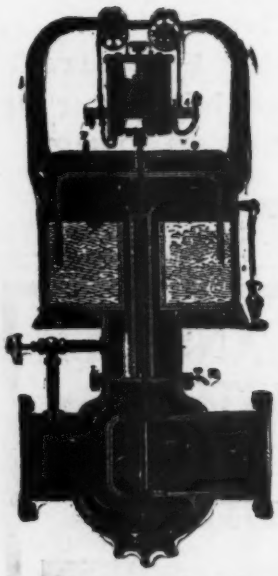

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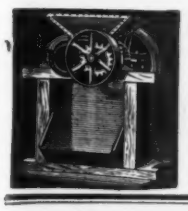

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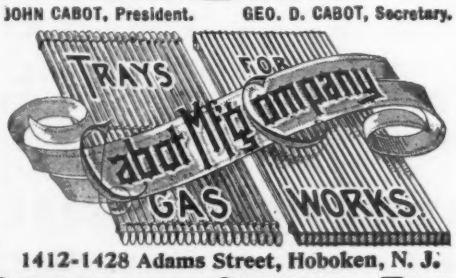

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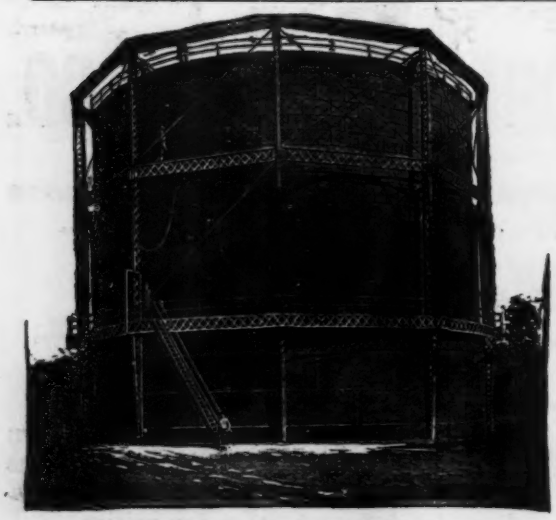

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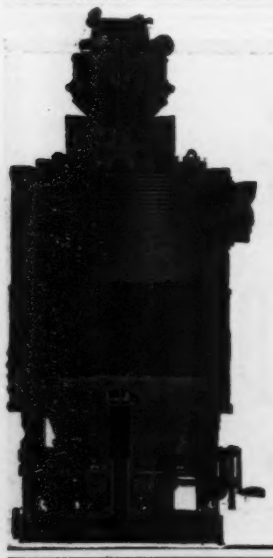

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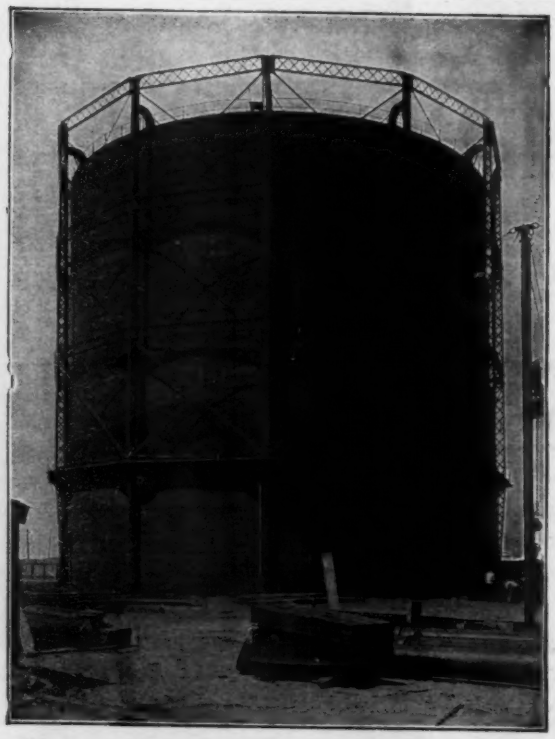

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